

MINERALOGICAL ABSTRACTS

(Vol. 4, No. 6, June, 1930.)

Notices of Books.

WINCHELL (N. H.) [1839-1914] & WINCHELL (A. N.). *Elements of optical mineralogy: an introduction to microscopic petrography*. Second edition by Alexander N. WINCHELL. Part III, *Determinative tables*. New York (John Wiley & Sons) and London (Chapman & Hall), 1929, xii+204 pp., 3 pls. Price \$4.50 (22s. 6d.).

This third volume completes the much enlarged second edition (1922-29) of a useful text-book (which first appeared as a single volume in 1909), and in the meantime a third edition of Part I has been issued [M.A. 2-2, 3-413, 4-4]. Table I (pp. 8-9) lists minerals that are opaque in micro-sections of rocks, giving the characters seen in ordinary light. In Table II (pp. 12-75) minerals are arranged in the order of their birefringence with subdivisions according to refringence (n , ω , or β), optical sign, colour, cleavage, elongation, extinction, &c., giving in all a complex and arbitrary arrangement in 207 groups. Table III (pp. 80-115) is arranged according to the colours of minerals as seen in micro-sections, with subdivisions according to pleochroism, birefringence, and refringence, giving 99 groups. Table IV (pp. 118-173) is in order of the refringence of (a) isotropic minerals and (b) anisotropic minerals, with a rather confusing system of arrows to indicate the range in values. Table V (pp. 176-186) of the dispersion of the refringence of minerals is a modification of that previously given [M.A. 4-206]. A full index of mineral names shows that there is much duplication in the tables. The three plates in a pocket at the back of the book include: (1) a large coloured plate of birefringences, printed in Paris, and the same (except for the inscriptions) as that first given by Lévy and Lacroix in 1888; (2) a new chart plotting the birefringence against the refringence of rock-forming minerals, which so become differentiated into separate areas; (3) a 'Wulff' stereographic 'plat' (net) of 5 cm. radius printed on translucent paper for the reproduction of white prints. The tables are not so conveniently arranged for ready reference as those of E. S. Larsen (1921), but an ideal method of tabulating optical data has yet to be devised. The book is well printed, but

there are a few misprints, e. g. 'Frauenhofer' for Fraunhofer. There is not much reason for using French symbols for refractive indices and less for changing them from n_p, n_m, n_g to N_p, N_m, N_g . To describe minerals with an index of refraction less than that of Canada balsam as negative, and those with a higher index as positive, is surely introducing an unnecessary confusion. L. J. S.

ROSICKÝ (Vojtěch). *Krystalografie. I. Krystalografie popisná*. [I. Descriptive crystallography.] Praha (České Akad.), 1929, 504 pp., 4 pls., 560 text-figs.

This book successfully accomplishes the double purpose of providing an elementary text-book on geometrical crystallography and a detailed manual dealing with crystal measurement, calculation, and drawing. In the first part the thirty-two crystal-classes and their theoretical deduction are clearly explained and illustrated by numerous well-selected drawings. Other chapters deal with crystallographic projections, instruments, habit of crystals and their surface characters, twin-laws, and the morphology of aggregates. The introduction in crystallographic work is based on two-circle methods and the gnomonic projection; but formulae for zonal calculations and spherical triangles are also given, and the use of the stereographic projection is thoroughly explained. F. S.

WEINSTEIN (Michael). *Precious and semi-precious stones*. Second edition, London (Sir Isaac Pitman & Sons), 1930, x + 148, 17 pls., 4 text-figs. Price 7s. 6d.

This well-written popular book on precious stones has within a few months reached a second edition, in which there are some alterations and a few additions with an increase of ten pages. The information given is reliable, though there are a number of minor points that still require revision. The nomenclature follows on mineralogical lines and does not give undue prominence to misleading trade-names. After a brief introduction on general characters, there are chapters on diamond, ruby and sapphire, emerald, opal, and pearl, these being 'precious stones', all others being ranked as 'semi-precious'. Interesting subjects have been chosen for the plates (pl. IV is poor), but the few text-figures are roughly drawn. A good three-colour plate represents some stones in the Museum of Practical Geology, London. The author has evidently made good use of the excellent little guide-books on gem-stones issued by the Victoria and Albert Museum and the Museum of Practical Geology [M.A. 2-146],

but it is strange that he has not come across an edition of Dana's 'Mineralogy' later than 1854. L. J. S.

PEACH (Benjamin Neeve) [1842-1926] & HORNE (John) [1848-1928]. *Chapters on the geology of Scotland*. Oxford (University Press) and London (Humphrey Milford), 1930, xvi + 232, 18 pls., 27 text-figs. Price 10s. 6d.

Like most things geological, this book is a fragment, but a very interesting and important fragment. Fortunately, the chapters on the North-West Highlands, which form the larger part of the book, were left in a finished state by the joint authors. This is followed by short chapters dealing with the Lewisian and Torridonian of Islay, Jura, and other western isles, which were left in the form of Peach's draft as submitted to Horne. The editors (M. Macgregor, E. B. Bailey, and R. Campbell) add a preface and a brief explanatory appendix. The text deals largely with geological structures, but mention is made of the different kinds of rocks, and petrographical descriptions by J. J. H. Teall and J. S. Flett are quoted in detail. The result is a nice book issued at a reasonable price (especially as it contains three folding coloured plates and many other good plates), and it forms a fitting memorial to Peach and Horne, whose joint names have been held in veneration by many students. L. J. S.

RIES (H.). *Economic geology*. 6th edition, New York (J. Wiley & Sons) and London (Chapman & Hall), 1930, v + 860 pp., 75 pls., 291 text-figs. Price 30s.

The popularity of this text-book in America is shown by its having passed from a fifth to a sixth edition in only five years. Its title, however, is distinctly misleading, and might better be Economic geology of the United States, for other countries receive but a very bare mention, only Canada receiving attention in sufficient detail to be of any use. Many of the errors and omissions noted in the earlier editions [Min. Mag. 18-145, M.A. 3-63] have been corrected, but there continue to be many notable omissions. To mention a few, witherite, Iceland-spar, and amber are completely omitted, while radium has only a few lines under uranium. Although the United States is the principal producer of pollucite, now of appreciable economic importance, this mineral too is not mentioned. The details of non-American localities are generally incomplete and not always reliable; for example, on p. 776 Madras and Bombay Presidencies are placed in Central India. For European students, the book can-

not be regarded as other than a useful book of reference on the economic minerals of the United States, and to a lesser extent of Canada.
M. H. H.

HOLMES (Arthur). *Petrographic methods and calculations, with some examples of results achieved*. London (T. Murby & Co.), 1930, [second impression], xix + 515 pp., 4 pls., 83 text-figs. Price 15s.

By reprinting this book page for page by the phototype process the publishers have been enabled to reduce the price to less than half that of the original edition [M.A. 1-177, 2-97]. There are no alterations in the text.
W. C. S.

MARR (J. E.). *Deposition of the sedimentary rocks*. Cambridge (University Press), 1929, vi + 245 pp., 8 figs. Price 7s. 6d.

The author has treated his subject on broad general lines, discussing the conditions which have affected the deposition of sediments in space and time. No attempt is made to give a detailed account of the lithology, nor are changes suffered by sediments subsequent to their formation discussed at any length. The book is somewhat outside the usual scope of these abstracts, but a notice of it is included because of its value as a guide to the application of the study of detailed lithology and to the interpretation of the physical conditions under which deposits have been formed.
W. C. S.

New Minerals.

KOCH (Sándor). *Fülöppit, egy új ásvány Nagybányáról.—Fülöppit, ein neues Mineral von Nagybánya*. Magyar Tudom. Akad. Mat. Természett. Értesítő, 1929, vol. 46, pp. 663-671 (Hung.), p. 672 (Germ.), 4 figs.

FINÁLY (István). *A fülöppit és keeleyit kémiai elemzése.—Chemische Analyse von Fülöppit und Keeleyit*. Ibid., pp. 673-675 (Hung.), p. 676 (Germ.).

See Min. Mag., 1929, vol. 22, p. 179.

PALMER (Leroy A.). *Kernite or rasorite?* Engin. and Mining Journ. New York, 1927, vol. 123, p. 494.

— *Concerning rasorite*. Ibid., 1928, vol. 125, pp. 207-208.

GALE (Hoyt S.). *Naming the new borate mineral*. Ibid., 1928, vol. 125, p. 702.

The name kernite [M.A. 3-271] has published priority, but the mineral had been earlier called rasorite by the Borax Company, and this has been used by them as a trade-name.
L. J. S.

EAKLE (Arthur S.). *Probertite, a new borate*. Amer. Min., 1929, vol. 14, pp. 427-430, 4 figs.

Rosettes (3 cm. diam.) of columnar crystals occur embedded in kernite, secondary borax, and greenish-grey shales in the kernite deposit [M.A. 3-271] in Kramer district, Kern Co., California. The mineral is colourless, glassy, and brittle, and is monoclinic with prismatic cleavage. Sp. gr. 1.91, H. 3-4, optically positive, 2V large, $\gamma:c = 12^\circ$, α 1.515, β 1.520, γ 1.538. It is slightly soluble in hot water, and readily in acids. Analysis, B_2O_3 47.80, CaO 12.76, Na_2O 14.03, H_2O 24.83, gives the formula $Na_2CaB_6O_{11} \cdot 6H_2O$, analogous to that of hydroboracite ($CaMgB_6O_{11} \cdot 6H_2O$). Kernite and probertite are the primary minerals of the lode-like deposit in Miocene beds, and they were evidently deposited, together with the associated realgar, orpiment, and stibnite by hot springs. Borax and ulexite are later crystallizations at ordinary temperatures.

L. J. S.

SCHALLER (Waldemar T.). *Borate minerals from the Kramer district, Mohave desert, California*. Prof. Paper U.S. Geol. Survey, 1930, no. 158-I (for 1929), pp. i-ii, 137-170, 6 pls., 27 text-figs.

A detailed description is given of the several minerals in the extensive borate deposit recently discovered by boring in the Kramer district, Kern Co. Colemanite occurs as small aggregates in ulexite, from which it has been derived. A satin-spar variety of ulexite fills veins in the clay-shale; this has sp. gr. 1.963, α 1.493, β 1.506, γ 1.519, $\gamma:c$ about 20° , and gave an analysis B_2O_3 42.94, CaO 14.06, Na_2O 7.09, H_2O 35.54, insol. 0.10 = 99.73, agreeing with the usual formula $Na_2O \cdot 2CaO \cdot 5B_2O_3 \cdot 16H_2O$. *Kramerite*, a new species [evidently identical with probertite, preceding abstract], has the formula $Na_2O \cdot 2CaO \cdot 5B_2O_3 \cdot 10H_2O$, i. e. the same as ulexite with less water. It forms radiating groups of colourless and transparent, slender monoclinic prisms embedded in the clay, kernite, or borax; $a:b:c = 1.1051:1:0.5237$, $\beta = 72^\circ 16'$, forms a (100), b (010), m (110), t (101), d ($\bar{1}01$), e (011), p (111), o ($\bar{1}11$); perfect cleavage m (110). Sp. gr. 2.141, H. $2\frac{1}{2}$. Optic axial plane (010), $\gamma:c = -12^\circ$, α 1.515, β 1.525, γ 1.544, positive, 2V 73° . The mineral is attacked by water; analysis (mean of three after deducting 0.99 % insoluble) gave B_2O_3 50.44, CaO 15.45, Na_2O 8.53, H_2O 25.58. The mineral was prepared artificially by the method of van't Hoff. Kernite [M.A. 3-271; = rasorite] forms a deposit a hundred feet thick in the clay-shales, and some of the

crystals reach eight feet across. The material readily breaks up into clear and colourless cleavage prisms. Small crystals suitable for measurement were found embedded in the larger crystals; they are monoclinic (not orthorhombic as previously stated), with $a:b:c = 1.5230:1:1.6989$, $\beta = 71^\circ 8'$; besides the three pinakoids, there are 5 clinodomes and 28 orthodomes, also many vicinal orthodomes, but no prisms or pyramids. The perfect cleavages are a (100) and c (001), on which the etch-figures are different in character. Sp. gr. 1.908, H. $2\frac{1}{2}$. Optic axial plane \perp (010), $\gamma = b$, $\beta:c = -19\frac{1}{2}^\circ$, negative, $2V$ 80° , α 1.454, β 1.472, γ 1.488. Kernite was prepared artificially, but only with difficulty, by heating borax at 150° in contact with its water of crystallization. Tincalconite (of C. U. Shephard, 1878), the 5-hydrate of the borax series, readily forms by the partial dehydration of borax ($\text{Na}_2\text{O} \cdot 2\text{B}_2\text{O}_3 \cdot 10\text{H}_2\text{O}$) and by the hydration of kernite ($\text{Na}_2\text{O} \cdot 2\text{B}_2\text{O}_3 \cdot 4\text{H}_2\text{O}$), occurring on these as a dull white film of minutely crystallized material. Several analyses are given. Artificial tincalconite, the so-called 'octahedral borax', is rhombohedral with the forms cr ; sp. gr. 1.880, ω 1.460, ϵ 1.473. The borax in the deposit is massive. Other minerals present in small amounts are calcite, realgar, and stibnite. The origin of the deposit is discussed. It was probably at first a lake deposit of borax which after being covered over by sediments was subjected to heat from an igneous intrusion. A complete list of boron-bearing minerals is added, and the physical characters of those which differ in degree of hydration are compared.

L. J. S.

[LABUNTZOV (A. N.)] Лабунцов (А. Н.). Ферсманит—новый минерал из Хибинских тундр.—LABUNCOV (A.) (LABOUNTZOW (A.)). *La fersmanite un nouveau minéral des Monts Chibines*. Докл. Акад. Наук СССР (Compt. Rend. Acad. Sci. URSS), Leningrad, Ser. A, 1929, pp. 297–301, 2 figs. (Russ.).

The mineral occurs, sometimes with lamprophyllite, apatite, and pectolite, in a nepheline-microcline-aegirine dike-rock on the Vuon-nemioka river in the Khibine (Umptek) Mts., Kola peninsula. The crystals (1 cm.), previously mistaken for sphene, occur singly or intergrown in groups. They are monoclinic with tetragonal habit; $a:b:c = 0.99113:1:0.99613$, $\beta = 82^\circ 44'$. Predominating forms are (001), (223), ($\bar{1}12$), with (110), ($\bar{2}23$), ($\bar{5}53$), and subordinate (106), (506), (101), (100), ($\bar{3}01$). Optic axial plane (010), B_x , nearly \perp (001). $2V$ $0^\circ - 7^\circ$, negative; α 1.886, β 1.930, γ 1.939.

Analysis I (also K_2O 0.37) by N. P. Vrevskaya, and II (sp. gr. 3.44) by N. I. Vlodavetz give the approximate formula $2R_2(O, F_2).4RO.4TiO_2.3SiO_2$ or $4RTiO_3.2R_2Si(O, F_2)_3.SiO_2$. Chemically, the mineral is rather near to molengraaffite from Transvaal, but in physical and optical characters it is quite distinct from this.

	SiO ₂ .	TiO ₂ .	Fe ₂ O ₃ .	FeO.	MnO.	MgO.	CaO.	Na ₂ O.	H ₂ O.	F.	Total.
I.	23.42	37.95	0.34	1.36	—	—	25.15	8.10	0.84	3.09	100.62
II.	22.30	37.34	0.45	0.30	0.25	0.08	26.16	9.88	1.26	3.61	101.63

P. N. C.

ROSS (Clarence S.) & KERR (Paul F.). *Dickite, a kaolin mineral*. Amer. Min., 1930, vol. 15, pp. 34–39.

Three kaolin minerals are distinguished, viz. kaolinite, dickite, and nacrite, which differ in their optical characters and also in the X-ray patterns and dehydration curves. Dickite, $2H_2O.Al_2O_3.2SiO_2$, from Amlwch, Anglesey (A. B. Dick, Min. Mag., 1888, 8–15, 1908, 15–124) and Red Mtn., Colorado, has $Bx_a = b$, positive.¹ Kaolinite, $2H_2O.Al_2O_3. \pm 2SiO_2$, the common constituent of kaolin, has Bx_a at $1-3\frac{1}{2}^\circ$ to the normal to the basal cleavage, negative. Nacrite, $2H_2O.Al_2O_3.2SiO_2$, from Freiberg, Saxony, is closer to dickite.

L. J. S.

IIMORI (Satoyasu) & YOSHIMURA (Jun). *A pink kaolin, and ruthenium as a minor constituent of the Tanokami kaolins*. Bull. Chem. Soc. Japan, 1929, vol. 4, pp. 1–5, 1 fig.; Sci. Papers Inst. Physical and Chemical Research, Tokyo, 1929, vol. 10, pp. 224–218, 1 fig.

A pink clay from weathered granite at Tanokami hill, prov. Omi, Japan, has n 1.515 and gave on analysis SiO_2 53.91, TiO_2 0.03, Al_2O_3 26.28, rare-earth oxides (mainly Yt_2O_3) 0.67, Fe_2O_3 1.69, FeO 0.26, MnO 0.39, MgO 0.09, CaO 0.12, Na_2O 1.03, K_2O 0.62, F (less O equiv.) 0.03, loss on ignition 15.60 = 100.72. This corresponds with $2Al_2O_3.7SiO_2.7H_2O$, with an $Al_2O_3:SiO_3$ ratio intermediate between that for catlinite and montmorillonite, and on this account the mineral is called 'takizolite'. X-ray absorption spectra and arc spectra indicate the presence of ruthenium and rhodium, and it is believed that the pink colour is due to these.

L. J. S.

¹ On p. 35 given in error as negative. The dispersion of the optic axes, regarded as a distinguishing character, is differently stated on pp. 35 and 37 for both dickite and kaolinite.

CUVELIER (V.). *Analyse van enkele zuivere stoffen, technische producten en kobaltmineralen*. Natuurwetenschappelijk Tijdschrift, Antwerpen, 1929, vol. 11, pp. 170-179.

Analyses of some pure cobalt compounds, technical products, and cobalt minerals from Katanga. Partial analyses are given of selenolinnæite [M.A. 3-362], asbolane, and heterogenite [M.A. 1-243]. A crystalline mineral from Mindingi gave Co_2O_3 68.72, Al_2O_3 6.87, Fe_2O_3 9.45, CuO 2.68, H_2O 10.15 = 100.54, corresponding with $(\text{Fe}, \text{Co}, \text{Al})_2\text{O}_3 \cdot \text{H}_2\text{O}$. This is regarded as the crystalline equivalent of the colloidal heterogenite, and is named *stainierite*. L. J. S.

PARTRIDGE (F. C.). *A new tin mineral from South-West Africa*. Trans.

Geol. Soc. S. Africa, 1930, vol. 32 (for 1929), pp. 171-176, 1 pl.

The new mineral was found in a hydrothermal deposit in limestone near Arandis (see T. W. Gevers in same vol, p. 165) and is named *arandisite*. It is fibrous-massive; colour apple-green; lustre resinous; hardness 5; sp. gr. about 4.12; translucent in bulk but transparent in fragments; isotropic or weakly birefringent. The refractive index of the pale, isotropic variety is 1.706; that of the dark, weakly birefringent variety 1.82. Analysis of a carefully picked sample gave SiO_2 16.2, Al_2O_3 2.7, Fe_2O_3 1.3; CuO 0.9, SnO_2 70.9, moisture 5.0, loss on ign. 3.5 = 100.5, which is confirmed by three other partial analyses. The material appears to be a basic silicate of tin and approximates to the formula $3\text{SnSiO}_4 \cdot 2\text{SnO}_2 \cdot 4\text{H}_2\text{O}$. It is decomposed by hot concentrated sulphuric acid, and is not reduced in the presence of zinc and acid. S. J. S.

KEEP (F. E.). *Notes on nickel occurrences in the Great Dyke of Southern Rhodesia*. Trans. Geol. Soc. S. Africa, 1930, vol. 32 (for 1929), pp. 103-110, 1 pl.

Describes three occurrences of nickel minerals in the Umvukwe Range. Near Umvukwe geodetic station a bright emerald-green mineral forms a quarter-inch seam in red serpentine close to a dolerite dike. Analysis, SiO_2 33.26, Al_2O_3 36.81, Fe_2O_3 0.79, FeO 0.68, NiO 4.28, MgO 4.78, $\text{H}_2\text{O} + 13.67$, $\text{H}_2\text{O} - 5.71 = 99.98$, gives the approximate formula $(\text{Mg}, \text{Fe}, \text{Ni})\text{O} \cdot 2\text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2 \cdot 4\text{H}_2\text{O}$. Sp. gr. 2.27, H. 3. Structure fibrous, with negative elongation, and optical characters resembling deweylite. It is proposed to name this mineral *maufite*, after Mr. H. B. Maufe. A similar green material, not analysed, occurs as an edging to a large dolerite dike which cuts serpentine at

the Ethel asbestos mine. The largest deposit of nickel minerals occurs on Sheila's Luck chrome claims, Lomagundi district. It is found in serpentine of the Great Dyke, about a quarter of a mile from the western margin. The deposit consists of a vertical reef of deep-red chalcedony and serpentine, veined with a green nickel mineral which is supposed, from its optical properties, to be garnierite.

S. J. S.

STELLA STARRABBA (Francesco). *Zamboninite—una nuova specie minerale*. Boll. Soc. Geol. Italiana, 1930, vol. 48 (for 1929), pp. 259–263.

A new mineral found as mamillary masses with gypsum in an old fumarole channel in the scoria of 1669 on Monti Rossi, Etna, is named zamboninite (it being argued that the previous use of this name by M. Bauer, 1901, is not valid). The masses have a grey, stony crust, but in the interior the material is white, friable, and radially fibrous, with d 2.98–3.00, n 1.405–1.411, very weak birefringence with straight extinction and positive elongation. Analysis gave Mg 24.26, Ca 17.94, Mn n.d., Al 0.41, Fe trace, Na 0.31, K 0.05, F 55.57, H_2O 1.63 = 100.17, agreeing with the formula $CaF_2 \cdot 2MgF_2$. The grey exterior, with d 2.94–2.95, gave Mg 24.40, Ca 16.00, Mn 0.27, Al 1.46, Fe 0.12, Na 0.45, K trace, F 54.78, CO_2 1.39 H_2O – 0.87, H_2O + 1.07 = 100.81; this also being zamboninite with a small amount of admixed hydromagnesite, evidently due to alteration. It is probable that the mineral was not formed by direct sublimation, but by the action of fluorine vapours on descending solutions containing magnesium and calcium.

L. J. S.

LOKKA (Lauri). *Über Wiikit*. Bull. Comm. Géol. Finlande, 1928, no. 82, 68 pp., 12 figs.

Wiikite (of W. Ramsay, 1897) is found in pegmatite veins in granite-gneiss at several places in Impilahti parish, Lake Ladoga, Finland. It varies from pitch-black to wax-yellow in colour and shows wide ranges in density and chemical composition, even in different parts of the same specimen. Rough crystals with an orthorhombic habit resembling that of samarskite are occasionally found; measurement with the contact-goniometer gave $a:b:c = 0.536:1:0.528$. Thin sections show that the material consists largely of isotropic (metamict) material, and that it is not homogeneous. Several types of material are distinguished. One of these, named 'nuolaite', from the locality Nuolainniemi, shows an intimate intergrowth of a

black opaque crystalline material, which is anisotropic in reflected polarized light, and an almost colourless isotropic material. Analyses I-VI of different types of wiikite suggest a pyro-niobate (and tantalate), and those (VII and VIII) of 'nuolaite' a meta-niobate (and tantalate). 'Nuolaite' is further distinguished by the absence of uranium and by the presence of more thorium. Measurements are given of the radioactivity of these minerals. The $Pb/(U + 0.38 Th)$ ratio gives ages of 401 to 2527 million years.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Nb ₂ O ₅ ...	22.75	25.64	29.70	28.98	28.34	24.36	39.34	38.03
Ta ₂ O ₅ ...	13.09	11.80	16.53	14.69	14.25	11.08	24.56	22.41
TiO ₂ ...	14.35	5.25	3.64	3.45	11.52	6.06	6.47	7.45
SnO ₂ ...	—	—	0.03	trace	0.04	0.04	trace	trace
SiO ₂ ...	2.30	2.85	4.79	4.84	4.94	12.59	2.45	2.92
ZrO ₂ ...	0.20	0.17	0.33	0.32	0.20	trace	0.32	0.48
ThO ₂ ...	0.70	0.10	0.38	0.29	1.10	0.44	3.30	4.40
UO ₂ ...	5.28	4.98	8.47	7.87	9.93	4.33	—	—
UO ₃ ...	—	—	—	—	—	11.24	—	—
Yt ₂ O ₃ ...	22.30	29.27	13.40	12.88	7.60	1.70	6.73	7.02
CeO ₂ ...	6.24	3.93	1.88	1.50	0.52	1.12	3.57	2.02
Al ₂ O ₃ ...	0.12	0.18	0.45	0.66	0.52	0.75	0.35	0.24
Fe ₂ O ₃ ...	3.71	5.26	5.97	5.80	3.25	5.54	3.23	4.25
FeO ...	0.20	0.15	0.46	0.61	0.82	0.87	3.67	2.55
MnO ...	0.13	0.03	0.05	0.10	0.17	0.27	0.34	0.37
PbO ...	0.44	0.90	1.49	3.08	1.88	—	0.21	0.27
MgO ...	0.20	0.27	0.38	0.29	0.89	1.00	0.63	1.07
CaO ...	3.00	2.43	4.25	3.92	5.02	6.48	1.58	2.06
CO ₂ ...	—	—	—	—	—	1.35	—	—
S ...	0.08	0.20	0.32	1.24	0.38	—	—	—
H ₂ O (+110°)	4.19	5.91	6.12	7.23	5.97	6.21	2.67	3.61
H ₂ O (−110°)	0.34	1.03	1.61	2.56	2.86	4.88	0.61	1.22
	99.62	100.35	100.25	100.31	100.20	100.31	100.03	100.37
Sp. gr. ...	4.708	4.591	4.349	4.223	4.200	3.635	5.149	4.860
Hardness ...	5½	5½	5½	5½	5	5	6	6

L. J. S.

ALVIR (A. D.). *Antamokite, a new gold-silver telluride*. Philippine Journ. Sci., 1930, vol. 41, pp. 137-139, 1 pl.

This new mineral was detected microscopically on polished sections of the ore from a rich pocket in the Dickson vein at Antamok, Mountain Province, Philippine Islands. It is associated with quartz, chalcopyrite, and tetrahedrite, and is intimately intergrown with calaverite, from which it differs in its micro-chemical reactions. Particles gouged out with a needle showed the presence of gold and

tellurium with traces of silver. The deposit probably belongs to the class of young gold-silver lodes like those of Cripple Creek, Colorado.

L. J. S.

Colour of Minerals.

MACCARTHY (Gerald R.). *Iron coloration in rocks and minerals.*

Journ. Elisha Mitchell Sci. Soc., 1925, vol. 41, pp. 135-137.

— *Colors produced by iron in minerals and the sediments.* Amer. Journ. Sci., 1926, ser. 5, vol. 12, pp. 17-36, 2 figs.

— *The green color of certain ferrous minerals.* Amer. Min., 1926, vol. 11, pp. 321-325.

(2) A series of rocks and minerals is tabulated according to their $\text{FeO}/\text{Fe}_2\text{O}_3$ ratio, ranging from 0.0 to 22.82, with a roughly corresponding range in colour from red, through yellow, purple, blue, and green, to black. A number of experiments were made in colour changes in various rocks, minerals, and salts of iron during oxidation, reduction (dry and wet), and dehydration. Pure ferrous compounds are colourless, while ferric iron gives reds and yellows. It is concluded that blues are due to hydrous ferrous-ferric compounds (anhydrous ferrous-ferric compounds giving only grey and black). There is no evidence for the existence of green or purple iron compounds, and these colours are regarded as mixtures of blue with yellow or red.

(3) The colour of most green minerals in which ferric iron predominates (e.g. glauconite, serpentine, dufrenite) appears to be original, whilst in certain ferrous minerals (e.g. diopside, hornblende, chlorites) the green colour is probably secondary and due to partial oxidation.

L. J. S.

WILD (Georg O.) & KLEMM (R.). *Mitteilungen über spektroskopische Untersuchungen an Mineralien. I. Saphir.* Centralblatt Min., Abt. A, 1925, pp. 273-274.

— *II. Caesium haltige Berylle.* Ibid., 1925, pp. 295-296.

— *III. Topas. IV. Diamant.* Ibid., 1925, pp. 321-323.

— *V. Spodumen.* Ibid., 1925, pp. 324-326.

— *VI. Smaragd.* Ibid., 1926, pp. 21-22.

— *VII. Roter Spinell.* Ibid., 1926, pp. 29-30.

— *VIII. Rubin und IX. Alexandrit.* Ibid., 1926, pp. 30-33.

The lines shown in the arc-spectra given by various gem-stones are listed. The work was done in the Institut für Edelstein-Forschung at Idar on the Nahe. Sapphire (blue-green, from Queens-

land) gave the lines of Ti, Fe; artificial blue sapphire, Fe, Ti, Mg, Ni; and white sapphire (from Ceylon), Ag, Ge. Beryl (pink, from Madagascar), Cs, Ga, Mn, Ni, Cu, Zn, Sn, Pb, Li, Na. Topaz (yellow, from Brazil), Cr, Fe, Ag, Na, V. Diamond, C. Spodumene (colourless), Mn, Fe, Sn, Co, Na; spodumene (yellow), Mn, Co, Na; hiddenite (green), Cr, Na, Sn, V, Mn, Co, Ag, Ti, Li; kunzite, Mn, Fe. Emerald, Cr, Mg, Na, V, Na, Co, Mn. Spinel (red), Cr, Ti, V, Pb, Sn, Cu, Zn. Ruby (from Siam), Cr. Alexandrite (emerald-green), Cr, Sn, Na, Mg, Mn, Li, Pb, K, Ba, Co, Ni, Ti, V. L. J. S.

KLEMM (R.). *Über die Färbung einiger Mineralien durch Chrom.* Centralblatt Min., Abt. A, 1927, pp. 267-278.

Chromium has long ago been detected by analytic and spectroscopic methods in both red and green gem-stones—ruby, spinel, topaz, hyacinth, alexandrite, emerald, and hiddenite; and the depth of the colour varies with the amount of chromium present. Its presence is also shown by the bright red fluorescence which these stones display under the influence of cathode rays. Although Cr⁺⁺⁺ salts are green and those of Cr⁺⁺ red or yellow, it is suggested that the chromium is present as an isomorphous replacement of aluminium. In the case of zircon it is suggested that there is a replacement of Zr by Cr, the atomic radii of these being nearly the same. L. J. S.

DOELTER (Cornelio). *Das blaue Steinsalz.* Sitzungsber. Akad. Wiss. Wien, Math.-naturwiss. Kl., Abt. I, 1929, vol. 138, pp. 113-124, 9 figs.; Monatshefte Chem., 1929, vol. 52, pp. 241-252, 9 figs.

A review of the much discussed question of the cause of the blue colour in rock-salt, with some new observations. Although this colour may be induced in rock-salt by exposure to the emanations from radium, the author considers that the blue colour of the natural mineral is not due to radioactivity, but rather to the presence of pigments, perhaps iron, manganese, sulphur, or organic substances. L. J. S.

PRZIBRAM (Karl). *Eine durch Druck bewirkte Farbänderung (Piezochromie) bei Fluorit.* Anzeiger Akad. Wiss. Wien, Math.-naturwiss. Kl., 1928, vol. 65, pp. 274-275.

— *Über Piezochromie (Farbänderung durch Druck) bei natürlichen Mineralien.* Sitzungsber. Akad. Wiss. Wien, Math.-naturwiss. Kl., Abt. II a, 1929, vol. 138, pp. 263-269.

Powdered minerals were subjected to pressures up to 20,000 kg. per sq. cm. Under these conditions green and blue fluorite changes to

violet in colour, but there is little change in the colour of yellow and red fluorite. Baryte and tourmaline show no change. Yellow calcite from Joplin, Missouri, becomes a pale bluish-grey. These changes in colour due to pressure (piezochromatism) are attributed to distortions of the lattice structure and the splitting off of electrons from partially freed ions.

L. J. S.

PRZIBRAM (Karl). *Zur Theorie der Verfärbung des Steinsalzes durch Becquerelstrahlen*. Sitzungsber. Akad. Wiss. Wien, Math.-naturwiss. Kl., Abt. II a, 1926, vol. 135, pp. 197-211, 4 figs.

—— *Zur Deutung der Salzverfärbungen*. Ibid., 1926, vol. 135, pp. 213-226.

—— *Über die Verfärbung des gepreßten Steinsalzes*. Ibid., 1927, vol. 136, pp. 43-56, 6 figs.

—— *Weitere Versuche über die Verfärbung gepreßter Salze*. Ibid., 1927, vol. 136, pp. 435-446, 3 figs.

—— *Zur Theorie der Verfärbung des Steinsalzes durch Becquerelstrahlen, II*. Ibid., 1927, vol. 136, pp. 679-684, 2 figs.

—— *Bemerkungen über das natürliche blaue Steinsalz*. Ibid., 1927, vol. 136, pp. 685-688, 1 pl., 2 text-figs.

—— *Beiträge zur Salzverfärbung*. Ibid., 1928, vol. 137, pp. 409-419.

—— *Rekrystallisation und Verfärbung des Steinsalz*. Ibid., 1929, vol. 138, pp. 353-362, 1 pl., 2 text-figs.

—— *Ein Schema der Verfärbungserscheinungen bei Steinsalz*. Ibid., 1929, vol. 138, pp. 483-495.

—— *Bemerkungen über das natürliche blaue Steinsalz II*. Ibid., 1929, vol. 138, pp. 781-797, 2 pls., 5 text-figs.

—— *Verfärbung durch Radiumstrahlen und Rekrystallisation des Steinsalzes*. Anzeiger Akad. Wiss. Wien, Math.-naturwiss. Kl., 1929, vol. 66, pp. 8-9.

This array of titles, although not a complete list, is sufficient to indicate the intensive work recently done in the Institut für Radiumforschung in Wien on the puzzling blue coloration of rock-salt. Under a pressure of about 400 kg. per sq. cm. rock-salt acquires a yellow colour, and when it is afterwards exposed to the emanations of radium and then to light it becomes blue. This colour is dispelled by heat. Under greater pressure (2000 kg./cm²), sufficient to cause the recrystallization of the salt, there is no coloration; but under still greater pressure the effect is again obtained. These colour

changes are attributed to the electronic neutralization of loosely bound sodium ions in the distorted lattice. L. J. S.

BAYLEY (P. L.). *The coloration of kunzite and hiddenite by X-rays.* Journ. Opt. Soc. Amer., 1928, vol. 17, pp. 350-355.

Kunzite shows an absorption-band at 0.54μ , and hiddenite shows a number of bands between 0.368 and 3.7μ . After exposure to X-rays for 5 hours kunzite becomes bluish-green and then shows absorption-bands at 0.630 and 0.910μ . Hiddenite shows no marked change. The radiated kunzite when exposed to a strong electric light for 12 hours has the original pink colour completely restored.

L. J. S.

STUHLMAN (Otto, Jr.) & DANIEL (A. F.). *The X-ray phosphorescent and thermophosphorescent radiations of kunzite.* Journ. Opt. Soc. Amer., 1928, vol. 17, pp. 289-293.

The spectral distribution is determined of the glow from kunzite when excited by X-rays and by rise in temperature. When the mineral was heated, a rose-coloured glow began at about 168° and ceased at 400° . The accompanying colour changes—pink, colourless, and green—are attributed to the oxidation and reduction of the manganese contained in the mineral.

L. J. S.

WEIGEL (O.) & HABICH (G.). *Über Mineralfärbungen. I. Die Absorption rot gefärbter Mineralien im sichtbaren Teil des Spektrums.* Neues Jahrb. Min., Abt. A, 1928, vol. 57, pp. 1-56, 16 figs.

WEIGEL (O.) & UFER (H.). *Ueber Mineralfärbungen. II. Die Absorption einiger rot gefärbter Mineralien und künstlicher Präparate im sichtbaren und ultravioletten Teil des Spektrums.* Ibid., pp. 397-500, 1 pl., 33 text-figs.

The quantitative study of the colour of minerals by means of their absorption spectra, and comparison with the absorption spectra of artificial products the colouring agent of which is known, forms the most promising method for ascertaining the source of the colour. The absorption spectra of a number of red minerals, of some artificial spinels and rubies in which the colouring agent was known to be chromium, and of several pure chemical compounds (mainly chromium salts) have been investigated. Some of the mineral colours cannot yet be allocated to any agent, but two absorption bands at wavelengths about 440 to $460 \mu\mu$ and 405 to $430 \mu\mu$, forming the typical

absorption spectrum of ruby, red spinel, and pyrope, are certainly due to chromium. In almandine, two other absorption bands appear about 504 and 380 $\mu\mu$, due probably to trivalent iron, and the latter of these bands appeared in one ruby, two spinels, and one pyrope, in addition to the chromium bands. Hessonite generally shows only general absorption at the violet end, attributed to colloidal Fe_2O_3 , but one or two specimens showed signs of the chromium maxima as well, and were found on analysis to contain chromium. A rose quartz showed an absorption band about 480 to 500 $\mu\mu$, due to manganese. Red, yellow, and violet glasses, coloured by manganese, gold, copper, silver, carbon, didymium, selenium, and tellurium, and a green chromium glass, were also studied. It is unfortunate that many of the analyses are very unsatisfactory. M. H. H.

SCHLOSSMACHER (K.). *Absorption und Lichtbrechung der roten, blauen und violetten Spinelle von Ceylon*. Zeits. Krist., 1930, vol. 72, pp. 447-475, 10 figs.

The refractive indices and absorption coefficients of spinel plates are measured for many wave-lengths over a range 400-600 $\mu\mu$. The maxima and minima on the absorption curves occur at different wave-lengths for the red, blue, and violet varieties, but occur at the same wave-lengths for light and dark specimens of any one colour. In the latter case, plotting the absorption for plates of unit thickness shows that the difference in absorption does not remain constant with change in wave-length. The absorption curve of the violet spinels suggests the presence of both agents responsible for the colours of red and blue spinels, viz. Cr_2O_3 and FeO . F. A. B.

HACQUAERT (Armand L.). *Over groenachtig satijnspaat (calciet) uit Kipushi, Katanga.—Spath satiné verdâtre de Kipushi (Katanga)*. Natuurwetenschappelijk Tijdschrift, Antwerpen, 1928, vol. 10, pp. 7-9, 1 fig. [Flemish with French résumé.]

A globular aggregate of pale green colour from the Prince Leopold mine shows alternate bands with fibrous and finely granular structures. The fibres are elongated along the edge of the cleavage rhombohedron. The material, with sp. gr. 2.717, ω 1.657, ϵ 1.482, contains CO_2 44.24, CuO 0.095 %, and is calcite coloured by copper. A calcite coloured pink by cobalt has been previously described from the same region [M.A. 3-266; see also M.A. 3-553]. L. J. S.

DITTLER (E.). *Analytisch-synthetische Untersuchungen am Rotzinkerz.*
 Zeits. Anorg. Chem., 1925, vol. 148, pp. 332-344, 1 pl.

Zincite from Franklin Furnace, New Jersey, becomes brown when heated in air, regaining its original deep-red colour when heated in hydrogen; and on further reduction it becomes emerald-green. New analyses gave:

	ZnO.	MnO.	FeO.	Fe ₂ O ₃ .	Mn ₃ O ₄ .	Total.
I.	93.79	5.14	—	0.62	0.50	100.05
II.	93.14	6.20	—	0.38	0.34	100.06
III.	93.06	5.46	1.14	0.24	—	99.90
IV.	93.72	3.21	0.69	2.32	—	99.94

The melting-point of the material used for analysis II is 1670° \pm 10°; with increasing MnO and FeO this falls to 1550°. Experiments with artificial zincites containing variable amounts of manganese suggest that the characteristic deep-red colour of the mineral is due to the presence of Mn₃O₄. This might be produced by the reaction $3\text{MnO} + \text{CO}_2 \rightleftharpoons \text{Mn}_3\text{O}_4 + \text{CO}$ during the contact-metamorphism when zincite was formed from the earlier zinc ores.

L. J. S.

LANGE (Bruno) & EITEL (Wilhelm). *Die Bestimmung der Depolarisation des Tyndalllichtes als kolloidchemische und mineralogische Arbeitsmethode.* Neues Jahrb. Min., Abt. A, 1928, vol. 57, pp. 541-562, 11 figs.

The Tyndall light, that is the light scattered by a cloud of small particles, is always partially polarized, and it has generally been assumed that the polarization is complete for light scattered at right angles to the entrant beam. This is only the case for the light scattered by an isolated spherical particle; in all practical cases the polarization is incomplete, and by determining the actual degree of polarization it is often possible to decide whether the scattering particles are spherical or no. The method is applied to some glasses, and may be of assistance in determining whether the colour of some minerals is due to included particles of colloid dimensions or no.

M. H. H.

MÖHL (H.) & LEHMANN (H.). *Die Gelbfärbung von Bleiglasuren.* Sprechsaal für Keramik, Glas und verwandte Industrien. Fach- und Wirtschaftsblatt, 1929, vol. 62, pp. 463-465.

The yellow colour of lead-rich glasses is due to the presence of free lead oxide. Decolorization may be effected by the addition of

sufficient silica, boric oxide, or alkalis to the melt. Alkali earths have the opposite effect, since they combine more readily with the silica than does the excess lead oxide.

F. A. B.

HEINRICHS (Hermann). *Glasfärbung durch Metallsulfide*. Glastechnische Berichte, herausgegeben von der Deutschen Glastechnischen Gesellschaft, Frankfurt am Main, 1928, vol. 6, pp. 51-54.

HEINRICHS (H.) & BECKER (C. A.). *Studien über die Herstellung sulfidisch gefärbter Gläser*. Sprechsaal für Keramik, Glas und verwandte Industrien. Fach- und Wirtschaftsblatt, 1928, vol. 61, pp. 411-414, 2 text-figs.

Glasses containing metallic sulphides may be prepared by reducing metallic salts with aluminium powder in the molten glass. Commercial brown iron sulphide glasses, free from bubbles, may be economically prepared in this way; in order to guard against the oxidation of the iron sulphide to the oxide, that is, to prevent the formation of blue-green colours, the water-content of the raw materials must be low. Optical cadmium sulphide glasses may be readily manufactured by this method, but excess of this substance in the melt results in the deposition of small crystals of artificial greenockite. Copper and nickel sulphides, owing to their low solubility, do not yield transparent glasses. The authors add a note on the determination of free sulphur in glasses.

F. A. B.

Meteorites and Tektites.

MERRILL (George P.) [1854-1929]. *Composition and structure of meteorites*. Bull. U.S. Nat. Mus., 1930, no. 149, vi+62 pp., 33 pls.

This interesting account of the chemical and mineral composition and structure of meteorites by the late Professor Merrill contains little that is new, but expresses his well-known views, many of which, as we are warned in the foreword, may not be generally accepted. In the section on the mineral composition of meteorites little discrimination appears to have been exercised as to the reliability of the analyses quoted. Some are old and faulty, and that of Casas Grandes is incorrect, but this and a few other slips are doubtless due to the fact that the proofs of the bulletin were not read by the author. A full discussion of the nature and origin of the chondrules, with ample references to the literature, leads to the author's conclusion that only those of glass and cryptocrystalline

or radiating enstatite (used in its general sense, for no distinction is made in the paper between enstatite, bronzite, and hypersthene) are consistent with Sorby's theory of origin as fused drops of 'fiery rain', while those of rough exterior and internally porphyritic or holocrystalline show evidence of an origin of form through mechanical attrition. The section on the 'metamorphism of meteorites' gives the author's views as to the origin of the metallic iron in the stones by reduction from the chloride [M.A. 4-121], and as to the formation of the more crystalline chondrites, with imperfect chondrules, by the metamorphism of the tuffaceous kinds. Other sections deal with tektites, combustible meteorites, chondritic structure in terrestrial rocks, and methods of analyses of stony meteorites. The method of chemical analysis described is stated to be 'in substantial agreement with that used by Prior of the British Museum', but it certainly differs from that in one important respect, viz. in the use of the ammonia separation of iron and nickel instead of the more accurate sodium acetate method. The paper is copiously illustrated by as many as 77 figures contained in the 32 plates. As frontispiece is reproduced the latest photograph of the author, whose sudden death took place on August 15, 1929. G. T. P.

BÖGGILD (O. B.). *Untersuchungen über den Bau der Meteoreisen*. Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 66-76, 3 figs.

Deals with the oriented structures of the Savik meteoric iron [M.A. 3-535]. L. J. S.

BUSZ (K.). *Ein bei Oesede, unfern Osnabrück gefallener Meteorstein*. Veröffent. Naturwiss. Ver. Osnabrück, 1929, vol. 21, pp. - , 1 pl. (Reprint 4 pp.)

At Oesede in Hannover on December 30, 1927, at 11.30 a.m., a loud whistling noise was heard in the air, and then a crash on the frozen ground, and a cloud of dust was seen 30 metres away. A complete stone only slightly cracked was found half embedded in the ground with its point downwards. The whole stone weighed about 3,600 grams, but only fragments weighing 1,400 grams have been preserved. The form was a triangular pyramid with rounded edges, and the dimensions 15 × 10 cm. The fractured surface is pale grey and shows numerous small (1 mm.) chondrules set in a friable groundmass with specks of iron. A thin section shows the ground-

mass to consist of broken fragments of bronzite and olivine, and chondrules of the same minerals with a granular or eccentric radial structure. Fragments of feldspar are only rarely evident. The stone is classed as a spherulitic chondrite (Cc). Analysis by G. Brinkmann and E. Steinwachs gave Fe 18.17, Ni 1.90, FeS 5.77, SiO_2 35.57, Al_2O_3 2.71, FeO 7.99, MgO 23.24, CaO 2.96, Na_2O 1.32, K_2O 0.40, P trace = 100.03, corresponding with nickel-iron 20.07, troilite 5.77, feldspar 22, bronzite and olivine 52 %.

L. J. S.

FERNÁNDEZ NAVARRO (L.). *Meteorito de Ojuelos Altos*. Bol. R. Soc. Española Hist. Nat., 1929, vol. 29, pp. 19–24, 4 pls., 1 text-fig.

A meteoric stone fell at 9.30 a.m. on December 10, 1926, on cultivated ground near the road about 1 km. from the village of Ojuelos Altos in the district of Fuente Ovejuna, prov. Córdoba, Spain. It weighed 5,850 grams, and made a vertical hole 35 cm. deep. The fall was preceded by a noise like an aeroplane, and a brilliant object was seen in the sky travelling from east to west. There were six or seven violent explosions and white clouds were formed. Micro-sections show hypersthene, lime-feldspar, olivine, much magnetite with a border of haematite, and some glass. The texture is brecciated and tuffaceous with veinlets, and the stone much resembles a basalt-tuff. The stone is classed as a hypersthene oligo-chondrite. Sp. gr. 3.54 (on 66 grams), 3.89 (on a small piece of 5 grams). Analysis by F. Raoult of the magnetic (11.7 %) and non-magnetic fractions gave the following bulk composition: SiO_2 40.02, TiO_2 nil, Al_2O_3 2.77, FeO 11.34, MgO 25.34, CaO 2.49, Na_2O 0.76, K_2O 0.23, P_2O_5 0.34, H_2O (105°) 0.09, FeS 6.76, Fe 8.17, Ni 1.12, Co 0.04.

L. J. S.

FERNÁNDEZ NAVARRO (L.). *El meteorito de Olmedilla de Alarcón (Cuenca)*. Mem. R. Soc. Española Hist. Nat., 1929, vol. 15, pp. 859–865, 3 pls., 1 text-fig.

At midday on February 26, 1929, after two explosions, which were heard at Cuenca, 50 km. away, several stones fell, one in the district of Valverdejo to the east and the others in the district of Olmedilla de Alarcón, over an area of 7×3 km., alongside and just north of the main road from Madrid to Castellón. The sky was bright and no luminous effects were seen. The deepest hole made was 40 cm. The exact localities of eight stones are mentioned, and weights stated are about 14, 13, 2 libras [1 libra = 1.014 lb.

avoldupois], and another of about 1 kg.¹ The material is classed as an oligo-sidiferous hypersthene-chondrite with a marked brecciated texture and veined, approaching the eucrites, but perhaps representing a new type. There are chondrules of hypersthene, monoclinic pyroxene, and basic feldspar, and magnetite bordered with haematite is abundant. Sp. gr. 3.712. Analysis by F. Raoult of the magnetic (20.8 %) and non-magnetic fractions gave the following bulk composition: SiO_2 36.92, TiO_2 nil, Cr_2O_3 0.38, Al_2O_3 2.52, FeO 9.39, MnO 0.26, MgO 23.59, CaO 2.16, Na_2O 0.87, K_2O 0.19, H_2O (105°) 0.09, P_2O_5 0.31, FeS 4.66, Fe 17.06, Ni 1.58, Co 0.02. Brief particulars are given of some other meteoric stones that have fallen in Spain since 1858. L. J. S.

[CHIRVINSKY (P. N.)] Чирвинский (П. Н.). Исследование Оханского метеорита. — TSCHIRVINSKY (Pierre). *Examen de la météorite d'Okhansk*. Извест. Донск. Политех. Инст. Новочеркасск (Izvest. Don. Polytech. Inst. Novocherkassk), 1928, vol. 10 (for 1926–27), pp. 140–154, 2 pls. (Russ. with French résumé, pp. 152–154.). The French résumé also issued in Ann. Inst. Polytech. Don, Novotcherkassk, Résumés des Articles, 1928, vol. 10 (for 1927), pp. 16–18.

Fuller details of work on which two preliminary accounts have already been published [M.A. 2–33]. L. J. S.

[CHIRVINSKY (P. N.)] Чирвинский (П. Н.). Брагинский палласит, его количественный минералогический и химический состав. — TSCHIRVINSKY (P. N.). *Pallasit von Brahlin, seine quantitative mineralogische und chemische Zusammensetzung*. Извест. Донск. Политех. Инст. Новочеркасск (Izvest. Don. Polytech. Inst. Novocherkassk), 1929, vol. 11 (for 1928), pp. 194–213, 3 figs. (Russ. with Germ. summary 4 pp.).

From notes left by the late P. I. Grishchinsky [Min. Mag. 20–259] mention is made of further masses of the Brahlin pallasite [M.A. 2–258, 3–255], viz. two of 45.8 and 34.15 kg. in Kiev University, and one of 1,376 grams in the Academy of Sciences at Leningrad. These were found 3–4 versts from the village of Kolyban, Rechitza district, Minsk govt.; also a piece of 543 grams, said to have been taken from a large block of 18–20 pud [1 pud = 16.38 kg.] 40–50

¹ Exact weights and the total weight are not given. In a preliminary account (Bol. R. Soc. Española Hist. Nat., 1929, vol. 29, pp. 145–146), stones of about 30, 7, and 2 kg. are mentioned.

verts east of Mozyr. Details are given of the measurements [M.A. 2-84] of the areas of olivine and nickel-iron on six slices of the meteorite, giving the volume of the olivine as 57.03 % (limits 52.23-73.58 %) and the weight percentage as 37.18. From this proportion of olivine and nickel-iron and the composition of each, the bulk composition of the meteorite is calculated.

L. J. S.

[KULIK (L. A.)] Кулик (Л. А.). Метеорит Мамра.—KULIK (L.). *Le [sic] météorite de Mamra*. Докл. Акад. Наук СССР (Compt. Rend. Acad. Sci. URSS), Ser. A, 1929, pp. 81-82, 3 figs.

This chondrite fell during the night of May 5, 1927, near the Mamra springs on the border of the Chimbaisky and Kzyl-Ordynsky districts in Kazakstan, western Siberia. According to the natives, who broke up the stone, the original weight was about 1 kg.; a fragment weighing 58.8 grams is in the Mineralogical Museum of the Academy of Sciences in Leningrad.

P. N. C.

KULIK (Leonid). *Auffindung des tungusischen Riesenmeteors vom 30. Juni 1908*. Petermanns Mitt., 1928, vol. 74, pp. 338-341, 1 fig. (sketch-map).

Translation by C. Gross from a newspaper (Krasnoyarsk Workers' News of August 9, 1927) of an account of the great meteor of June 30, 1908, near the Stony Tunguska river in central Siberia [M.A. 2-257, 3-92], and of the difficulties encountered in the unsuccessful attempts to find the meteorite. L. Kulik was guided to the spot by the pine-trees that had been swept down by the blast of hot air over an area of several thousand square kilometres. Ten craters with diameters of 10-50 metres and an average depth of 4 m. were found in swampy ground, and from the size of these the weight of the elusive meteorite is estimated at 130 tons. [Cf. Science, New York, March 22, 1929, n. ser., vol. 69, supplement p. xii; Amer. Min., 1929, vol. 14, pp. 201-202.]

L. J. S.

LUYTEN (Willem J.). *The Grootfontein meteorite*. South African Journ. Sci., 1929, vol. 26, pp. 19-20.

This large mass of meteoric iron,¹ estimated at not less than 50 tons, appears to have been known locally for almost twenty years

¹ A photograph of the mass has been reproduced by H. Schneiderhöhn, Zeits. Prakt. Geol., 1929, vol. 37, p. 95. He states that it was known since about 1920, and gives the dimensions as $3 \times 1\frac{1}{2} \times 1\frac{1}{2}$ m. and the estimated weight as 50 tons. Cf. Min. Mag., 1930, vol. 22, p. 272.

on the farm Hobas West [Hobas West] near the railway siding Otjihaenene, 12 miles west of Grootfontein, South-West Africa. It is a rectangular block 10×9 feet with a thickness of $2\frac{1}{2}$ to nearly 4 feet. The large flat surface is horizontal. When first found only a small portion was exposed, and a pit has now been dug round it. Analysis by the South West Africa Company at Grootfontein gave Fe 81.29, Ni 17.42 %, sp. gr. 7.96. An etched surface shows traces of crystalline structure, but no Widmanstätten figures. L. J. S.

HODGE-SMITH (T.). *The Elsinora meteorite: a new chondrite from New South Wales.* Rec. Austr. Mus., 1929, vol. 17, pp. 50-52, 1 pl.

A meteoric stone measuring about 10 or 12×6 inches was found in 1922 in a sandy paddock on Elsinora Station, $29^{\circ} 27' S.$, $143^{\circ} 36' E.$ [Delalah Co.]. The two fragments preserved weigh 1,797 grams. It is a veined grey chondrite and of the Cronstad type with Fe:Ni = 13.7 and MgO:FeO = 5. The nickel-iron is fairly evenly distributed, but sometimes as veins. Analyses of the portions attracted and unattracted by an electro-magnet gave the bulk composition: SiO₂ 35.47, Al₂O₃ 2.02, Fe₂O₃ 0.17, FeO 9.14, MgO 25.21, CaO 1.56, Na₂O 0.82, K₂O 0.01, H₂O 0.41, TiO₂ 0.05, P₂O₅ 0.10, Cr₂O₃ 0.34, MnO 0.07, CuO trace, FeS 4.78, Fe 18.23, Ni 1.31, Co 0.02 = 99.71; sp. gr. 3.595—corresponding with the mineralogical composition: feldspar (Ab₄₄An₁₀) 9.04, bronzite 22.52, olivine 42.30, apatite 0.31, chromite 0.45, troilite 4.78, magnetite 0.23, ilmenite 0.15, nickel-iron 19.56, water 0.41 = 99.75.

L. J. S.

MERRILL (George P.), with chemical analysis by F. A. GONYER. *A newly found meteoric stone reported by W. B. Lang from Peck's Spring, Midland County, Tex.* Proc. U.S. Nat. Mus., 1929, vol. 75, art. 16, 2 pp., 1 pl.

This stone was found in 1926 in Texas. The piece of 800 grams received for examination represents rather less than half the entire mass. The stone is unusually dense and hard, dark grey to almost black, and thickly studded with firmly embedded grey chondrules. Minute specks of metal and sulphide are thickly distributed through the mass. The metal sometimes forms a fringe around the chondrules. A micro-section shows a finely brecciated structure with broken chondrules of enstatite and olivine in a granular ground-mass. Analysis gave Fe 5.03, Ni 0.42, Co 0.01, Cu 0.002, FeS 2.27,

SiO₂ 37.57, Al₂O₃ 7.12, Cr₂O₃ 0.35, FeO 20.80, NiO 0.55, MgO 22.71, CaO 2.14, Na₂O 0.78, K₂O 0.21, P₂O₅ 0.24 = 100.202. L. J. S.

HEINEMAN (Robert E. S.) & BRADY (L. F.). *The Winona meteorite*. Amer. Journ. Sci., 1929, ser. 5, vol. 18, pp. 477-486, 7 figs.

A rusty weathered mass was found in 1928 in a stone cist amongst the prehistoric ruins of the Elden Pueblo near Winona in northern Arizona. It fell to pieces when taken out, and the total weight of the fragments was 53 lb. Green stains consist of the nickel carbonate zarathite (isotropic, n 1.595). Micro-sections show silicate aggregates veined with nickel-iron, troilite, and limonite, or rounded aggregates and grains (chondrules?) of silicates in a matrix of troilite and limonite. The nickel-iron shows well-marked Widmanstätten figures, and the silicates are olivine, enstatite, and plagioclase. Analysis gave SiO₂ 19.84, TiO₂ 0.05, Cr₂O₃ 0.17, Al₂O₃ 4.09, Fe₂O₃ 32.12, FeO 16.01, NiO 3.86, CoO 0.33, MnO 0.06, MgO 12.03, CaO 1.13, Na₂O 0.74, K₂O 0.06, S 5.30, P 0.00, H₂O- 0.96, H₂O+ 4.80, CO₂ n.d., metallic Fe 0.38, Ni 0.06, Co 0.01, total (less O for S) 100.83. The mass is therefore an altered siderolite (grahamite), with abundant troilite. L. J. S.

NININGER (H. H.). *The Sandia Mountains meteorite*. Amer. Journ. Sci., 1929, ser. 5, vol. 18, pp. 412-413, 3 figs.

A description is given of an irregular fragment of iron weighing 90 grams, which was sent to the author in 1927 and said to have been taken from a mass of about 100 lb. found in the Sandia Mountains, near Albuquerque, New Mexico, but since lost. An etched surface shows a few 'typical Neumann lines', which are almost obscured by sets of fine lines in four directions [evidently also Neumann lines]. Analysis by F. G. Hawley gave Fe 99.55, Ni 5.75, Co 0.39, Cu 0.08, Cr 0.02, Mn trace, P 0.23, S 0.04, C 0.04, SiO₂ 0.05, O 0.32 = 99.47; Pt 0.73 oz. per ton. The iron is classed as hexahedrite. L. J. S.

TCHIRVINSKY (P.) [= CHIRVINSKY (P. N.)]. *Sur l'application à la minéralogie de la méthode des réactions chimiques retardées par diffusion dans un milieu colloïde*. Bull. Soc. Franç. Min., 1924, vol. 47, pp. 133-135.

A proposal to extend the well-known methods of using reagents in gelatine solution for studying the oxidation of iron for the purpose

of detecting inclusions of schreibersite and troilite in polished sections of meteoric irons. F. A. B.

NININGER (H. H.). *Notes on oxidation of certain meteorites—meteorodes* [i.e. meteorodes]. McPherson College Bulletin [McPherson, Kansas, U.S.A.], Special issue March 25, 1929, 4 pp., 6 figs.

The absence of fossil meteorites in sedimentary rocks is commented upon, and it is suggested that they may perhaps be represented by certain iron concretions. On a recent visit to the spot where the Brenham pallasite was found in 1882 in Kiowa Co., Kansas, a number of iron concretions were found in a patch of swampy ground. These nodules, for which the name 'meteorodes' is suggested, consist of limonite with Ni 1.47 %, and are hollow or contain a sandy core representing the silicate portion of the original meteorite. L. J. S.

CHAPMAN (Frederick). *Obsidian buttons: an Australian riddle*. In: *Open-air studies in Australia*. London and Toronto (J. M. Dent & Sons), 1929, pp. 144-149, 2 figs.

A brief account of the nature of australites, or obsidianites, and the theories that have been proposed to explain their origin. Their forms can be matched with the glass blebs mingled with the 'Pele's hair' of Kilauea, and also in the blebs of fused coke ejected from the smoke-stacks of steam-locomotives. The 'bubble theory' of E. J. Dunn [M.A. 1-49], supported by C. G. Thorp, is mentioned with others. Theories of volcanic and meteoritic origin are both regarded as unsatisfactory. The view, long held by the author, and proposed also by E. J. Alexander, is that the australites are aerial fulgurites caused by the fusion by lightning of the fine dust such as that causing the well-known phenomenon of 'red rain'. W. C. S.

X-rays and Crystal-structure.

Crystal-structure and chemical constitution. A general discussion held by the Faraday Society, March, 1929, [Reprinted from Trans. Faraday Soc., London, 1929, vol. 25], pp. 253-420, 7 pls., text-figs. Price 8s. 6d.

A collection of twenty-one papers by various authors with general discussion.

WHITLOCK (Herbert P.). *How atoms build*. Natural History (Journ. Amer. Mus. Nat. Hist.), New York, 1929, vol. 29, pp. 629-637, 12 figs.

A popular explanation of the modern theory of crystal-structure, illustrated by photographs of models of sodium chloride, zinc sulphide, diamond, graphite, and calcite. W. C. S.

GOTTFRIED (C.). *Röntgenographische Untersuchungsmethoden*. Glas-technische Berichte, herausgegeben von der Deutschen Glas-technischen Gesellschaft, Frankfurt am Main, 1928, vol. 6, pp. 177-183.

The chief methods of the investigation of solids by means of X-rays are described. The powder method is in general the most fruitful for industrial work, since it is sometimes the only way of identifying a new component formed in a system of crystalline solids. Amorphous and crystalline substances can be readily distinguished, and a direct application to glass technology lies in the identification of the products of devitrification of a glass. The greenish colour which develops in a lead glass used for electrical insulators is proved to be due to the separation of finely divided particles of lead. F. A. B.

BRAGG (W. Lawrence). *An optical method of representing the results of X-ray analysis*. Zeits. Krist., 1929, vol. 70, pp. 475-492, 12 figs.

A close analogy may be drawn between the examination of a two-dimensional pattern under the microscope and the examination of X-ray diffractions from a zone of planes in a crystal. In either case when a wave-train falls upon a complex grating the amplitudes of the waves in the spectra formed are proportional to the coefficients of a Fourier series, which when summed reproduces the form of the grating [M.A. 4-97]. Light passing through a plate prepared with harmonic bands of light and shade is allowed to fall upon a sheet of photographic paper with the form of the face (100) of a crystal cell, in this case diopside, outlined upon it. The inclination of the bands is adjusted for each pair of spectra $F(Ok\bar{l})$, $F(O\bar{k}l)$, and the exposure given is proportional to the amplitude of the X-ray diffractions already measured [M.A. 4-31]. If the structure be approximately known beforehand then it is also known whether a light or dark band should pass through the centre of the cell,

i. e. the phases of the components as well as the amplitudes must be given. When the paper is developed an image of the crystal cell projected on the face (100) appears with the atoms in the correct positions. By taking three 'micro-photographs' on the three faces of the cell the actual position of the atoms can be found and most of the fourteen atomic parameters determined. F. A. B.

GEORGE (Wm. H.). *On the interpretation of X-ray crystal photographs.* —Part II. *Complete rotation photographs.* Phil. Mag., 1929, ser. 7, vol. 8, pp. 442-456, 1 pl., 1 text-fig.

A mathematical instrument constructed on nomographical principles directly interprets complete rotation photographs of cubic, tetragonal, hexagonal, and rhombohedral crystals. The co-ordinate or row-line reading of any spot on a rotation photograph is first obtained, preferably by means of the grid-method [M.A. 4-97], and then a simple setting of the instrument for the particular wavelength used and the cell-edge involved enables the indices of the plane producing the spot to be read directly. With the same setting the indices of the planes corresponding to all the other spots can also be read. Useful tables for reciprocal lattice methods of interpretation for cubic, tetragonal, and hexagonal crystals are given.

F. A. B.

COX (E. G.) & SHAW (W. F. B.). *Correction factors in the photographic measurement of X-ray intensities in crystal analysis.* Proc. Roy. Soc. London, Ser. A, 1930, vol. 127, pp. 71-88, 2 charts, 2 text-figs. [Cf. M.A. 3-521, 4-97.]

The integrated intensities of X-ray reflections by crystals recorded on photographic films and plates must not only be subjected to the usual correction factor for polarization but in addition must be corrected for the obliquity of incidence of the reflected X-rays on the photographic emulsion. In the case of the rotating crystal a geometrical factor must also be applied for reflections from planes inclined to the axis of rotation. Charts have been constructed for the plane plate and cylindrical film for reading directly the last correction factor. Values of the obliquity or absorption factor are tabulated for Doneo films and $K\alpha$ copper radiation. The corrections are tested for planes of equal reflecting power that give reflected spots on different regions of the same photograph.

F. A. B.

MAUGUIN (Ch.). *Réseaux polaires et diagrammes de diffraction des rayons X*. Bull. Soc. Franç. Min., 1926, vol. 49, pp. 5-32, 14 figs.

The conception of the reciprocal lattice is applied in a slightly different form from that of Ewald's [M.A. 1-218] to Laue and rotation photographs. Various substances whose structures are well known are used as examples.

F. A. B.

BRILL (Rudolf) & PELZER (H.). *Röntgenographische Teilchengrößenbestimmung II*. Zeits. Krist., 1929, vol. 72, pp. 398-405, 1 pl., 6 text-figs.

The method previously described [M.A. 4-19] is limited to preparations which strongly absorb X-rays, and moreover depends on the assumption that the readings of the photometer are proportional to the intensity of the beam. If a hollow cylinder of the particles suspended in collodion be used, a preparation of negligible absorption, then each interference splits into two maxima whose distance apart is a measure of the size of the particles. The method is applied to particles of magnesium oxide and gives results in agreement with the first method.

F. A. B.

NOLD (A.). *Über Kristallstruktur. III*. Zeits. Krist., 1929, vol. 71, pp. 169-182, 14 figs.

A further contribution to the theory of structures made up of carbon atoms, which is based upon previous work [M.A. 4-67, 164].

F. A. B.

BRINDLEY (G. W.). *A note on the scattering power of the carbon atom in diamond for X-rays*. Phil. Mag., 1930, ser. 7, vol. 9, pp. 204-208, 1 fig.

The author's theoretical scattering power curve for carbon is supported by Miss Armstrong's recent experimental results (Phys. Rev., 1929, vol. 34, p. 1115) rather than by Ponte's [M.A. 4-22]. The electrons of the *K* ring are supposed to be chiefly responsible for X-ray scattering; the *L* electrons contribute appreciably to the scattering power curve only at small values of the angle θ where the experimental data are meagre.

F. A. B.

MAUGUIN (Ch.). *Structure du graphite*. Bull. Soc. Franç. Min., 1926, vol. 49, pp. 32-61, 4 pls., 10 text-figs.

Rotation photographs of graphite from laterites of Madagascar have a unit hexagonal prism cell whose base-edge *a* and height *c* are

2.46 and 6.74 Å.; the cell contains twelve carbon atoms. The most probable structure is discussed and comparison made with the results of previous workers. [Cf. Bernal, M.A. 2-507.] F. A. B.

JAMES (R. W.), BRINDLEY (G. W.), & WOOD (R. G.). *A quantitative study of the reflexion of X-rays from crystals of aluminium.* Proc. Roy. Soc. London, Ser. A, 1929, vol. 125, pp. 401-419, 3 figs.

The temperature-factor deduced from measurements of the intensity of reflection of X-rays by single crystals of aluminium at ordinary temperatures and at the temperature of liquid air agrees well with the Debye-Waller theory. From the temperature-factor the amplitude of the heat motions of the atoms in the aluminium lattice can be estimated. The absolute values for the intensity of reflection are concordant with recent theory assuming the existence of zero-point energy [M.A. 4-20, 21]. F. A. B.

KONOBEJEWSKI (S.). *Über eine feste Lösung von Eisen in Graphit.* Zeits. Krist., 1929, vol. 72, pp. 381-397, 9 figs.

After graphite and iron are mixed together and heated, the mixture on cooling gives X-ray photographs which differ from those of pure graphite, though showing some similarity with those given by some natural graphites. The difference is probably due to the formation of a solid solution of iron and carbon (perhaps Fe_2C), the molecules of iron filling up gaps in the graphite space-lattice.

H. H.

WYCKOFF (R. W. G.). *The scattering power of metallic silicon for molybdenum and for copper radiation.* Zeits. Krist., 1930, vol. 73, pp. 181-186, 3 figs.

The relative intensities were measured of the chief powder reflections of metallic silicon for molybdenum and copper $\text{K}\alpha$ radiations. By comparing silicon with sodium chloride the scattering power of silicon for molybdenum X-rays was calculated, and similar results were obtained for copper radiation by assuming that the scattering power for (220) of NaCl is the same as it is for molybdenum.

H. H.

SEKITO (Sinkiti). *On the crystal structure of manganese.* Zeits. Krist. 1929, vol. 72, pp. 406-415, 7 figs.

α -Manganese is stable up to 800°. Its structure is cubic, the unit cell containing 58 atoms and having an edge of 8.904 Å. β -Man-

ganese is stable between 800° and 1100° . Its structure is also cubic, the unit cell containing 20 atoms and having an edge of 6.288 \AA . γ -Manganese is stable above 1100° . Its structure is tetragonal. For the unit cell $a = 3.747 \text{ \AA}$, $c/a = 0.961$. With the γ -modification copper forms solid solutions, the value of c/a increasing with increase of the copper and approaching unity for about 20 % copper. H. H.

HENDRICKS (Sterling B.), JEFFERSON (M. E.), & SHULTZ (J. F.) *The transition temperatures of cobalt and nickel, some observations on the oxides of nickel.* Zeits. Krist., 1930, vol. 73, pp. 376-380, 1 fig.

Cobalt has hexagonal close-packed modifications below 400° C . and above 1015° C . In between these temperatures a cubic form is stable. Nickel is probably cubic at all temperatures studied. The magnetic transformation temperatures of nickel and cobalt are not temperatures of structural change. A repetition of methods that have been described for preparing Ni_2O_3 gave only NiO , and earlier experiments had been probably misinterpreted. H. H.

GREENWOOD (Gilbert). *Fibre texture in nickel wires.* Zeits. Krist., 1929, vol. 72, pp. 309-317, 8 figs.

— *A correction to my communication on fibre texture in nickel wires.* Ibid., 1930, vol. 73, p. 442.

Cold-drawn nickel wire of diameter 0.26 mm . was examined by X-rays. The unit cube has an edge of length $3.515 \pm 0.002 \text{ \AA}$, and the lattice is face-centred. Crystal particles are arranged so that the $[111]$ and $[100]$ directions are parallel to the axis of the fibre. The diameter of the wire was reduced by etching successively to 0.11 and to 0.055 mm ., so that its nature at varying depths could be investigated. H. H.

ROBERTS (H. S.) & KSANDA (C. J.). *The crystal structure of covellite.* Amer. Journ. Sci., 1929, ser. 5, vol. 17, pp. 489-503, 4 figs.

Covellite from Summitville, Colorado, and artificial CuS , have a hexagonal unit cell of dimensions $a = 3.802$, $c = 16.43 \text{ \AA}$. ($c/a = 4.321$), containing six copper atoms and six sulphur atoms. The space-group is D_{6h}^4 , and the structure explains the perfect basal cleavage and the possibility of gliding parallel to the base.

L. J. S.

FULLER (M. Luther). *The crystal structure of wurtzite*. Phil. Mag., 1929, ser. 7, vol. 8, pp. 658-664.

X-ray powder photographs have been obtained for artificial wurtzite prepared by heating zinc sulphide with 10 % NaCl at 1100° C. The observed intensities of the lines are consistent with the structure proposed by W. L. Bragg [M.A. 2-329]. The powder photographs of previous workers are inconsistent with this result owing to the admixture of zinc-blende with natural wurtzite [M.A. 2-195, 3-20]. The cell-dimensions for wurtzite prepared as above and presumably free from the cubic form are $a = 3.811 \pm 0.004$, $c = 6.234 \pm 0.006$ Å. ($c/a = 1.636$). The calculated density is 4.10 ± 0.01 . F. A. B.

JONG (W. F. de). *Die Kristallstruktur von Germanit*. Zeits. Krist., 1930, vol. 73, pp. 176-180, 2 figs.

The structure of germanite is probably of the zinc-blende type with the space-group T_d^2 and a unit cell having an edge of 5.290 Å. and containing one molecule of $\text{Cu}_3(\text{Fe,Ge})\text{S}_4$. H. H.

GRUNER (John W.). *Structures of sulfides and sulfosalts*. Amer. Min., 1929, vol. 14, pp. 470-481, 7 figs.

A review is given of the various types of structure met with amongst metallic sulphides, mineral and artificial. The sulphosalts (chalcopyrite, stannite, linnaeite, bornite, pentlandite, sulvanite, and tetrahedrite are considered in more or less detail) also show the same types of structure, except that two or more constituent metals occupy at least two structurally non-equivalent positions. This is the case with pentlandite, which is therefore classed as a sulphosalt rather than as a sulphide. Structural radicals are distinguishable only in the pyrite group, pentlandite, and sulvanite. Except in the larger lattices of molybdenite, the sulphur atoms show a close-packed cubic or hexagonal arrangement at the corners of regular or slightly distorted tetrahedra. The size of these tetrahedra depends on the radii of the associated metal atoms, the tetrahedral edge ranging from 3.09 Å. in pyrite to 4.62 Å. in Na_2S . L. J. S.

BRINDLEY (G. W.). *The amplitude of vibration of ions in the crystals NaCl, NaF, LiF, and KCl*. Phil. Mag., 1930, ser. 7, vol. 9, pp. 193-203, 3 figs.

The experimental work of James and others [M.A. 4-20, 21] justifies the assumption of approximate equivalence of the charge

distribution in an ion at rest in a crystal and the charge distribution of a free ion as deduced theoretically by Hartree. The comparison of X-ray scattering curves obtained experimentally for various ions in structures of the rock-salt type with the corresponding theoretical curves for the ions at rest leads to an estimate for the amplitude of vibration of the ions at room-temperatures.

F. A. B.

WYCKOFF (Ralph W. G.) & ARMSTRONG (Alice H.). *The X-ray diffracting power of chlorine and ammonium in ammonium chloride.* Zeits. Krist., 1929, vol. 72, pp. 319–326, 5 figs.

The intensities of reflection of molybdenum $K\alpha$ radiation were measured for the first nineteen X-ray diffraction lines of ammonium chloride powder. From these the X-ray scattering curves of chlorine and ammonium in that compound were calculated. H. H.

PAULING (Linus). *On the crystal structure of nickel chlorostannate hexahydrate.* Zeits. Krist., 1930, vol. 72, pp. 482–492, 3 figs.

The unit cell of $\text{NiSnCl}_6 \cdot 6\text{H}_2\text{O}$ is a rhombohedron containing one molecule and having edges of length 7.09 Å., the angle between two fundamental translations being $96^\circ 45'$. The space-group is probably C_{3i}^4 , though C_3^4 is possible. H. H.

WYCKOFF (Ralph W. G.) & ARMSTRONG (Alice H.). *The scattering powers of the atoms in magnesium oxide and sodium fluoride.* Zeits. Krist., 1930, vol. 72, pp. 433–441, 7 figs.

The intensities of reflections in powder X-ray photographs of carefully prepared MgO and NaF were measured, giving curves which show the variation with the angle of diffraction of the scattering powers of magnesium, oxygen, sodium, and fluorine atoms. H. H.

GOßNER (B.) & ARM (M.). *Chemische und röntgenographische Untersuchungen an Stoffen und Kristallen von komplexer Bauart.* Zeits. Krist., 1929, vol. 72, pp. 202–236, 11 figs.

Some complex substances were examined chemically and by X-ray methods with the object of deducing a formula of such molecular weight that a whole number of complete molecules shall be accommodated in the unit cell. Such complex substances usually show a high degree of crystal symmetry. Metavoltine, $\text{K}_5\text{H}_7(\text{SO}_4)_6 \cdot 3\text{Fe}(\text{OH})_3 \cdot \text{H}_2\text{O}$, prepared artificially [M.A. 3–479] as hexagonal prisms with perfect basal cleavage, has sp. gr. 2.396, $a = 19.43$, $c = 18.60$ Å., $a : c = 1 : 0.957$, with eight molecules in the unit cell,

and is optically uniaxial and negative. Voltaite $K_2H_{10}(SO_4)_6 \cdot 3(Fe,Al)(OH)_3 \cdot 4FeSO_4 \cdot 4H_2O$, prepared artificially as octahedral or rhombic-dodecahedral crystals, has sp. gr. 2.651, and the unit cube of edge 27.33 Å. contains twenty molecules; the space-group is probably O_h^5 . Mangan-voltaite and cobalt-voltaite, with $4MnSO_4$ and $4CoSO_4$ in place of $4FeSO_4$, were also prepared; they are cubic with marked optical anomalies. Voltaite and cobalt-voltaite could not be prepared with Fe''' or Al alone; but the pure Fe''' salt, as well as the mixed salt, was obtained for mangan-voltaite.

Boleite gave on analysis of cubo-octahedral crystals: Pb 49.51, Ag 8.66, CuO 17.71, Cl 19.98, H_2O 4.84 = '100.34', sp. gr. 5.188. The unit cube of edge 15.40 Å. contains nine molecules $3PbCl_2 \cdot 3Cu(OH)_2 \cdot AgCl$. The space-group is O_h^1 , and there are no strong optical anomalies. [These results differ appreciably from those given in the preliminary note, M.A. 4-28.] Cumengeite, occurring as tetragonal pyramids on the six faces of cubes of boleite, has sp. gr. 4.73 and 4.78, cell-dimensions $a = 15.17$, $c = 24.71$ Å., $a:c = 1:1.629$, and space-group D_{4h}^{17} . The practical equality of the a dimensions of boleite and cumengeite allows of the parallel growth of these two minerals. Analysis, Pb 54.17, CuO 19.93, Cl 19.13, H_2O 6.19 = 99.42, gives the formula $4PbCl_2 \cdot 4Cu(OH)_2 \cdot H_2O$. Calculation gives eleven such molecules in the unit cell, but this number does not agree with the body-centred structure. To fit the X-ray data there must be forty-four molecules $PbCl_2 \cdot Cu(OH)_2$ in the unit cell. The so-called "cubic boleite", or pseudoboleite, occurring as simple cubes, is distinguished by a higher birefringence of its outer zones. Analysis (Pb 49.33, CuO 17.72, Ag 8.65, Cl 19.91, H_2O 4.67 = 100.28), sp. gr. 5.187, and the X-ray patterns show that this is the same as the cubo-octahedral crystals of boleite; and the surface differences are evidently due to an intergrowth with cumengeite. General remarks are added on pseudo-symmetry brought about by complex lamellar twinning and on optical anomalies.

L. J. S.

FRIEDEL (G.). *Sur la boléite, la pseudoboléite et la cumengéite. Réponse à MM. Gossner et Arm.* Zeits. Krist., 1930, vol. 73, pp. 147-158, 1 fig.

The author draws attention to his measurements on the pyramidal cleavages exhibited by boleite and pseudoboleite (1906) which yielded

axial ratios $c/a = 3.996$ and $c/a = 2.023$, respectively. These results are opposed to those of Gossner and Arm [preceding abstract], who deduce from their X-ray data cubic not tetragonal cells. He gives a new specific gravity measurement of 5.04 for boleite, and using Gossner and Arm's value of the cell-edge $a = 15.4 \text{ \AA}$. shows that the unit tetragonal cell would contain twelve molecules $9\text{PbCl}_2 \cdot 8\text{CuO} \cdot 3\text{AgCl} \cdot 9\text{H}_2\text{O}$. Similarly, the tetragonal cell for pseudoboleite would be half the size of the boleite cell and would contain twelve molecules $5\text{PbCl}_2 \cdot 4\text{CuO} \cdot 6\text{H}_2\text{O}$. X-ray work on these minerals is to be published shortly.

F. A. B.

GOTTFRIED (C.) & NAGELSCHMIDT (J. G.). *Über die Struktur einiger komplexer Cyanide*. Zeits. Krist., 1930, vol. 73, pp. 357-364.

The salts $\text{K}_3\text{Fe}(\text{CN})_6$, $\text{K}_3\text{Cr}(\text{CN})_6$, $\text{K}_3\text{Mn}(\text{CN})_6$, and $\text{K}_3\text{Ir}(\text{CN})_6$ form a pseudo-orthorhombic isomorphous series with space-group C_{2h}^5 , or V_h^{14} if they are considered as orthorhombic. The unit cell contains four molecules and has edges a, b, c of lengths 13.42, 10.40, 8.38; 13.55, 10.60, 8.60; 15.56, 10.60, 8.50; 13.70, 10.53, 8.34 \AA . for the four substances respectively. The cyanide $\text{Cs}_3\text{Fe}(\text{CN})_6$ is not isomorphous with the above salts, for the unit cell contains only two molecules and has edges given by $a = 11.8$, $b = 10.1$, $c = 7.0 \text{ \AA}$.

H. H.

BARNES (William Howard). *The crystal structure of ice between 0°C . and -183°C* . Proc. Roy. Soc. London, Ser. A, 1929, vol. 125, pp. 670-693, 2 pls., 6 text-figs.

A prism of ice, shown to be free from twinning by examination in polarized light, gave by the rotating crystal method a hexagonal unit cell containing four molecules whose cell-edges are $a = 4.53_5$, $c = 7.41 \text{ \AA}$. The space-group is D_{6h}^4 or D_{3h}^4 , more probably the former. The positions of the diffracting centres in the unit cell are also given. Powder photographs of ice taken between 0°C . and -183°C . show that no change takes place in the structure over this range of temperature. The proposed structure agrees closely with that put forward by Dennison (1921) and W. H. Bragg (1922).

F. A. B.

BRANDENBERGER (E.). *Zur Frage der Kristallstruktur des Eises*. Zeits. Krist., 1930, vol. 73, pp. 429-430,

The claim of W. H. Barnes [preceding abstract] to have proved that the space-group of ice is probably D_{3h}^4 is criticized on the ground that other space-groups fit his observations equally well. H. H.

FULLER (M. Luther). *Precision measurements of X-ray reflexions from crystal powders.* Phil. Mag., 1929, ser. 7, vol. 8, pp. 585-586.

Independent measurements on pure cadmium oxide by P. van Dyke give cell-edge $a = 4.681 \pm 0.002$ Å. in agreement with the results of Brentano and Adamson [M.A. 4-106]. The author proposes cadmium oxide prepared by burning vacuum-distilled cadmium in air as a superior reference standard in powder work to sodium chloride.

F. A. B.

PAULING (Linus). *The crystal structure of pseudobrookite.* Zeits. Krist., 1930, vol. 73, pp. 97-112, 3 figs. [Cf. M.A. 3-250.]

Small plates of pseudobrookite from Arany, Transylvania, were examined by the Laue, oscillation, and rotation methods. The space-group is V_h^{17} and the X-ray data lead to the formula Fe_2TiO_5 , rather than $\text{Fe}_4\text{Ti}_3\text{O}_{12}$, the unit cell containing four molecules of the former type. The cell-edges are $a = 9.79$, $b = 9.93$, $c = 3.725$ Å.; hence the axial ratios are $0.986:1:0.375$ in agreement with the crystallographic axial ratios if the latter be referred to a unit with the c -axis tripled. The calculated density is 4.39. Certain X-ray reflections appearing on the photographs are to be referred to rutile inclusions, the latter being in a definite but unknown orientation to the axes of the pseudobrookite crystal. The presence of the rutile accounts for the high TiO_2 content reported in chemical analyses of natural pseudobrookite, and also led to the assignment of the incorrect formula $\text{Fe}_4\text{Ti}_3\text{O}_{12}$. The positions of the atoms in the structure have been found by supplementing the X-ray data with considerations of co-ordination and atomic radii. The structural units are distorted TiO_6 and FeO_6 octahedra, the atomic distances Ti-O lying between 1.91 and 1.95 Å., and for Fe-O between 1.90 and 2.25 Å. The octahedra are linked by sharing edges. No obvious relation exists between the structures of pseudobrookite and andalusite or brookite.

F. A. B.

KRIEGER (Philip). *Notes on an X-ray diffraction study of the series calcite-rhodochrosite.* Amer. Min., 1930, vol. 15, pp. 23-29, 2 pls., 1 text-fig.

Five specimens of manganocalcite from different localities show a regular increase in density and refractive indices with increasing manganese content between the extremes calcite and rhodochrosite (containing MnCO_3 95.72 %). The X-ray powder patterns are the

same in character throughout the series but with different spacings, the spacing $d_{(100)}$ for the unit rhombohedron decreasing with increasing manganese content.

MnCO ₃ ...	0.00	1.09	7.00	15.40	32.34	42.17	95.72 %
Sp. gr. ...	2.715	2.724	2.824	2.856	3.021	3.143	3.710
ω ...	1.658	1.662	1.672	1.680	1.713	1.721	1.817
ϵ ...	1.486	1.490	1.501	1.503	1.519	1.534	1.595
$d_{(100)}$...	3.075	3.055	3.020	3.005	2.975	2.948	2.850 Å.

L. J. S.

GARRABOS (L.). *Symétrie et macles de la dolomite étudiées au moyen des rayons X.* Bull. Soc. Franç. Min., 1926, vol. 49, pp. 110-127, 5 pls., 11 text-figs.

A study of dolomite from Djelfa (Algeria) by means of etch-figures and X-ray photographs. The etch-figures on the rhombohedral faces about the top end of the triad axis point to the left, whilst those about the bottom end point to the right. This shows that the only symmetry elements are a triad axis and a centre of symmetry. Laue photographs confirm the absence of planes and axes of symmetry other than a triad axis. Laue photographs also confirm the evidence of etch-figures, that, in addition to the twin obtained by rotation of 60° or 180° about the triad axis or twin-plane (111), penetration-twins of two crystals with parallel cleavages occur very frequently. The twin-law is a rotation of 180° about an axis perpendicular to the prism-face $(01\bar{1})$. The unit cell of dolomite containing one molecule of $\text{CaMg}(\text{CO}_3)_2$ has $a = 6.01 \text{ Å.}$, and angle between edges $\alpha 47^\circ 7'$. The density of the material used is 2.868, and refractive indices $\omega 1.678$, $\epsilon 1.499 \pm 0.002$. The author shows that the structure of dolomite is built up on similar lines to those of calcite, half the calcium atoms being replaced by magnesium atoms. The lower symmetry is accounted for by the CO_3 groups being displaced from the central position that they occupy in calcite. The (111) planes, for instance, consist of equidistant planes of alternate Ca and Mg atoms separated by planes of CO_3 groups, the latter being probably nearer the Mg than the Ca plane. This structure explains the frequent occurrence of the penetration-twin already mentioned.

F. A. B.

TUTTON (A. E. H.). *Significance of X-ray analysis of alkali sulphates.*

Phil. Mag., 1929, ser. 7, vol. 8, pp. 195-201.

Repetition of an earlier note [M.A. 2-104].

OFTEDAL (Ivar). *Über die Kristallstruktur von Bastnäsit*. Zeits. Krist., 1929, vol. 72, pp. 239–248, 2 figs.

Bastnäsite has the space-group D_{3h}^3 . The unit cell has edges given by $a = 7.094$, $c = 4.859$ Å., and contains three molecules of (Ce, La, Di)FCO₃. H. H.

OGG (A.), with note by A. E. H. TUTTON. *The space-group of the alkaline sulphates*. Phil. Mag., 1930, ser. 7, vol. 9, pp. 665–667. [Cf. M.A. 4–107.]

The space-group V_h^{16} is shown to be the only group which satisfies the spacings of the X-ray reflections. The dimensions of the unit cells of the alkali sulphates (R₂SO₄) deduced from Taylor and Boyer's (1928) X-ray data agree with the dimensions calculated from Tutton's values of the densities and axial ratios. The author also shows that the shortest distance between the centres of the metal and oxygen atoms calculated from the structures are in agreement with Pauling's values based on wave-mechanics. F. A. B.

ZACHARIASEN (W. H.). *The crystal structure of sodium perchlorate, NaClO₄*. Zeits. Krist., 1930, vol. 73, pp. 141–146, 1 fig.

Sodium perchlorate has the anhydrite structure with space-group V_h^{17} and a unit cell containing four molecules of NaClO₄ and with edges given by $a = 6.48$, $b = 7.06$, $c = 7.08$ Å. H. H.

GOßNER (B.) & MUßGNUG (F.). *Über kristallographische Beziehungen zwischen Kaliumdichromat und Ammoniumdichromat*. Zeits. Krist., 1930, vol. 72, pp. 476–481.

K₂Cr₂O₇ has a triclinic unit cell containing four molecules with dimensions given by $a = 7.50$, $b = 7.38$, $c = 13.40$ Å, $\alpha = 82^\circ 0'$, $\beta = 96^\circ 13'$, $\gamma = 90^\circ 51'$. (NH₄)₂Cr₂O₇ has a monoclinic unit cell containing four molecules with dimensions given by $a = 7.78$, $b = 7.54$, $c = 13.27$ Å., $\beta = 93^\circ 42'$. Its space-group is C_{2h}^6 . H. H.

GRUNER (John W.). *The structure of boracite*. Amer. Journ. Sci., 1929, ser. 5, vol. 17, pp. 453–460, 2 figs.

Gives the X-ray details of work previously published [M.A. 4–30]. The (100)-faces of twelve orthorhombic hemimorphic crystals give the faces of the composite rhombic-dodecahedron, and the positive ends of the polar c -axes (parallel to the shorter diagonal of the dodecahedral faces) point towards alternate pseudo-triad axes. The base-centred unit cell contains eight molecules Mg₆Cl₂B₁₄O₂₆, and the space-group is C_{2v}^{11} or C_{2v}^{12} , more probably the former. L. J. S.

MACHATSCHKI (Felix). *Berzeliit, ein Arsenat vom Formel- und Strukturtypus Granat* ($X_3Y_2z_3O_{12}$). Zeits. Krist., 1930, vol. 73, pp. 123-140, 2 figs.

The cell-edge of berzeliite from Långban, Sweden, is 12.537 ± 0.008 Å. The space-group is O_h^{10} . The author has derived from R. Mauzelius's analysis of soda-berzeliite $d = 4.21$, a formula of the type $X_3Y_2z_3O_{12}$, where X includes Na, Ca, Y includes Mn, Mg, and z includes As, V. The cubic unit cell of berzeliite contains eight molecules of this type and yields the value 4.20 for the calculated density. Powder photographs of berzeliite and garnet show a close resemblance, and the structures are the same, the Si atoms of the garnet structure being replaced by As atoms [M.A. 3-251]. The above formula represents the garnets, X including Ca, Mg, Mn, Fe, Y including Al, Fe, Cr, and z being essentially Si. The isomorphism of berzeliite and garnet and the underlying fact of the replacement of silicon by pentavalent arsenic is an illustration of V. M. Goldschmidt's rule of the diagonal series in the periodic table [M.A. 4-240].

F. A. B.

MACHATSCHKI (Felix). *Atopit und Mauzeliit, zwei nichtmetamikte Minerale vom Typus $X_2Z_2(O,OH,F)_7$ (Pyrochlore)*. Zeits. Krist., 1930, vol. 73, pp. 159-175, 3 figs.

The fragments of the crystals of atopite from Miguel Burnier, Minas Geraes, Brazil, examined optically by H. Rose [M.A. 1-355] were studied by the powder method. The cell-edge is 10.267 ± 0.008 Å. and the unit cell contains eight molecules of the type $[Ca, Mn, Na] Sb_2[O, OH, F]_7$ which reduces to the pyrochlore formula $X_2Z_2[O, OH, F]_7$ [M.A. 4-240]. The X-ray data confirm that atopite is isomorphous with the pyrochlore group, and the structure is obtained from that for pyrochlore by replacing the niobium by antimony atoms. The space-group is O_h^7 . Similarly, mauzeliite is isomorphous with the pyrochlores, and its formula is given by $[Ca_8Na_2][Sb_8Ti_2][O_{31}F_4]$. Berzeliite, however, is not isomorphous with the pyrochlores [see preceding abstract].

F. A. B.

GOßNER (B.) & MUßGNUG (F.). *Die Gitterkonstanten und die systematische Stellung von Wollastonit*. Centralblatt Min., Abt. A, 1929, pp. 175-185.

The unit cell of wollastonite with dimensions $a = 15.31$, $b = 7.35$, $c = 7.08$ Å., $\beta = 84^\circ 35'$, contains twelve molecules $CaSiO_3$; the space-group is probably C_{2h}^5 . This cell corresponds with an axial

ratio $a : b : c = 2.083 : 1 : 0.963$, $\beta = 84^\circ 35'$ i. e. with a double the length usually taken. The relation of wollastonite to other metasilicates of the pyroxene group is considered. L. J. S.

WARREN (B. E.). *The crystal structure and chemical composition of the monoclinic amphiboles*. Zeits. Krist., 1930, vol. 72, pp. 493–517, 7 figs.

Rotation photographs of cleavage fragments of tremolite, kupfferite, actinolite, black hornblende, and grünerite are practically identical in spacings and in intensities of spots. The space-group for all is C_{2h}^3 , and the tremolite structure is found to be typical of all the monoclinic amphiboles (M.A. 4–201). The cell-edges are:—

					a.	b.	c.
Tremolite, $H_2Ca_2Mg_5(SiO_3)_8$	...	...	...	...	9.78	17.8	5.26 Å.
Kupfferite, $H_2Mg_7(SiO_3)_8$	...	...	...	...	9.7	17.8	5.25
Actinolite, $H_2Ca_2(Mg,Fe)_5(SiO_3)_8$	...	...	...	...	9.8	17.9	5.27
Hornblende, $H_2(Ca,Na,K)_{2-3}(Mg,Fe,Al)_5[(Si,Al)O_3]_8$	...	...	...	...	9.8	17.9	5.28
Grünerite, $H_2Fe_7(SiO_3)_8$	...	...	...	...	9.4	17.9	5.27

Published chemical analyses of these amphiboles are recalculated giving the number of atoms of each kind on a basis of $24(O,OH,F)$. In this way the various atomic substitutions show up clearly and prove to be in accordance with the conception of atomic radii. In the hornblendes where Al replaces Si to a considerable extent, the vacant positions in the tremolite structure are occupied by alkali atoms, thus fulfilling the valency rule and agreeing with the results of chemical analysis. The author concludes that two formulae are necessary to represent the composition of the monoclinic amphiboles: (a) when there is a large (Na,Ca,K) content as in tremolite, actinolite, hornblende, $(OH,F)_2(Ca,Na,K,Mn)(Mg,Fe,Ti,Mn,Al)_5(Si,Al)_8O_{22}$, and (b) where the (Na,Ca,K) content is very small, $(OH,F)_2(Mg,Fe,Ca \dots)_7(Si,Al)_8O_{22}$. F. A. B.

BRAGG (W. Lawrence) & ZACHARIASEN (W. H.). *The crystalline structure of phenacite, Be_2SiO_4 , and willemite, Zn_2SiO_4* . Zeits. Krist., 1930, vol. 72, pp. 518–528, 3 figs.

Guided by the modes of atomic arrangements now known to exist in a large number of silicates, the authors complete their partial solution of the phenakite structure by assigning probable positions to the light beryllium atoms [M.A. 3–343]. Willemite has a similar unit cell and belongs to the same space-group [M.A. 3–432]. If the

beryllium atoms in the proposed phenakite structure be replaced by the heavier zinc atoms then the structure is found to be in agreement with relative intensity measurements around the [111] zone for willemite. Moreover, rotation photographs of willemite and phenakite about the [111] axis are satisfactorily explained by the proposed structures. A unit of pattern consists of an oxygen atom at the centre of an equilateral triangle with Si Be Be or Si Zn Zn at the corners. Compounds with structures of the same type are Li_2BeF_4 , Li_2MoO_4 , Li_2WO_4 [M.A. 3-432].
F. A. B.

GOßNER (B.) & KRAUS (O.). *Über Eudidymit und Epididymit. Ein Beitrag zur Kenntnis polymorpher Stoffe.* Centralblatt. Min., Abt. A. 1929, pp. 257-266.

Goniometric measurement of crystals of eudidymite from Norway gave the new orientation and axes $a : b : c = 1.725 : 1 : 1.918$, $\beta = 77^\circ 26'$, with the forms c (001), b (010), o ($\bar{1}12$), s ($\bar{1}11$), t (110). X-ray rotation photographs gave the edges of the unit cell containing eight molecules $\text{Si}_2\text{O}_5\text{Be.SiO}_3\text{NaH}$ as $a = 12.70$, $b = 7.34$, $c = 14.01$ Å. The space-group is C_{2h}^6 . These dimensions are very close to those for epididymite [M.A. 4-109, where the formula should be written $\text{Si}_2\text{O}_5\text{Be.SiO}_3\text{NaH}$; the cell dimensions are now given as $a = 12.65$, $b = 7.41$, $c = 13.53$ Å., and the space-group as V_h^{17}], but there is a wide difference in the axial angle β . The positions of the atoms are also very similar in the two minerals. This low degree of polymorphism is somewhat similar to that of α - and β -quartz.
L. J. S.

GOßNER (B.) & MUßGNUG (F.). *Über Davyn und seine Beziehungen zu Hauyn und Cancrinit.* Zeits. Krist., 1930, vol. 73, pp. 52-60.

A water-clear crystal of davyne from Monte Somma, Vesuvius, d 2.450, has a unit hexagonal cell whose dimensions are $a = 12.80$, $c = 5.35$ Å. A cleavage fragment of cancrinite from Miask, d 2.46, gives a unit hexagonal cell whose dimensions are $a = 12.60$, $c = 5.18$ Å. The unit rhomb-based cells of davyne and cancrinite are calculated to have maximum molecular weights of 1120 and 1060, respectively. These correspond to two molecules of $3\text{SiO}_4\text{AlNa.CaSO}_4$ per unit cell for davyne and two molecules of $3\text{SiO}_4\text{AlNa.CaCO}_3$ for cancrinite, but these formulae are not simply related to the results of chemical analysis. The photographs of davyne and cancrinite are almost identical and suggest a close relation in their structures. The authors

also trace a relationship between davyne and h  y  ne, and deduce almost the same cell-sides as those for davyne by setting up h  y  ne with its cube diagonal parallel to the *c*-axis of davyne. [M.A. 4-203.] F. A. B.

GO  NER (B.) & MU  GNUG (F.). *Beitrag zur Kenntnis des Kaliophilites*. Zeits. Krist., 1930, vol. 73, pp. 187-201, 2 figs.

A rotation-spectrogram of kaliophilite from Vesuvius (sp. gr. 2.610) gave a choice of two hexagonal structures. For one, the rhomb-based unit cell contains 54 molecules of KAlSiO_4 and has dimensions given by $a = 27.01$, $c = 8.59 \text{ \AA}$. ($c/a = 0.318$). For the other, based on the second-order prism, the unit cell contains 18 molecules, while $a = 15.59$, $c = 8.59 \text{ \AA}$. ($c/a = 0.5524$). The latter is less in accordance with observation of the intensity of the lines, but gives a size of unit cell closer to that found in most other substances. H. H.

CARDOSO (Gabriel Mart  n). *Sobre las orientaciones regulares de cristales y de sustancias paracristalinas*. Mem. R. Soc. Espa  ola Hist. Nat., 1929, vol. 15, pp. 465-486, 5 figs.

Further remarks on the regular intergrowth of kyanite and staurolite. [M.A. 3-529, 4-111]. L. J. S.

K  ZU (Shukusuk  ) & TAKAN   (Katsutoshi). *The axial ratio of topaz, obtained by using the Laue spots*. Sci. Rep. T  hoku Univ. Sendai, Japan, Ser. 3, 1929, vol. 3, pp. 171-175, 1 pl., 2 text figs.

The gnomonic projection of a Laue photograph taken in a direction at right angles to a (001) section of a topaz crystal from Naegi, Japan, yields the axial ratio $a : b : c = 0.5283 : 1 : 0.9540$, in close agreement with Koksharov's values. F. A. B.

ZACHARIASEN (W. H.). *The structure of thortveitite, $\text{Sc}_2\text{Si}_2\text{O}_7$* . Zeits. Krist., 1930, vol. 73, pp. 1-6, 1 fig.

Gossner and Mussgnug's unit cell dimensions and space-group determination are confirmed [M.A. 4-111]. Absolute intensity measurements were made on the face (110) of one individual of a large twin-crystal from Iveland, S  tersdalen, Norway; thence the positions of all the atoms in the unit cell were calculated. The structure is built up from nearly perfect SiO_4 tetrahedra, two tetrahedra sharing a corner, and ScO_6 polyhedra. The latter share three edges with neighbouring ScO_6 polyhedra. The distances Si-O and

Sc-O within the SiO_4 and ScO_6 groups are 1.62 and 2.18 Å., respectively.

F. A. B.

ZACHARIASEN (W. H.). *The crystal structure of titanite*. Zeits. Krist., 1930, vol. 73, pp. 7-16, 2 figs.

Yellow crystals of sphene from Lindvikskollen near Kragerø, Norway, were examined by the Laue, oscillation, and ionization-spectrometer methods. The unit cell contains four molecules CaTiSiO_5 ; its edges are $a = 6.55$, $b = 8.70$, $c = 7.43 \pm 0.01$ Å., and the angle $\beta = 60^\circ 17'$. The calculated density is 3.53. The space-group is C_2^6 , and the positions of the atoms in the unit cell have been found. The Laue method has in this case proved useful in helping to find the positions of the cations. The structure is made up from distorted SiO_4 tetrahedra, TiO_6 octahedra, and polyhedra of CaO_7 , the corresponding mean Si-O, Ti-O, and Ca-O distances being 1.64, 1.96, and 2.44 Å., respectively. Analyses of sphene usually reveal the presence of water. The author shows that the proposed structure obeys the valency rule more closely if certain oxygen atoms are replaced by OH.

F. A. B.

WYART (J.). *Structure de l'acétate basique de zinc déterminée au moyen des rayons X*. Bull. Soc. Franç. Min., 1926, vol. 49, pp. 148-159, 2 pls., 9 text figs.

This substance, $(\text{CH}_3\text{CO}_2)_6\text{Zn}_4\text{O}$, has density 1.903 ± 0.003 and its unit cell, of edge $a = 16.4$ Å., contains eight molecules. The space-group is probably O_h^7 , the eight molecules being arranged like the eight atoms of carbon in the diamond cell. There is only one way of accounting for the complete tetrahedral symmetry of the molecule. Basic zinc acetate has the structure accorded to basic beryllium acetate [M.A. 2-201].

F. A. B.

STAUDINGER (H.) & SIGNER (R.). *Über den Kristallbau hochmolekularer Verbindungen*. 17. Mitteilung über hochmolekulare Verbindungen. Zeits. Krist., 1929, vol. 70, pp. 193-210, 8 figs.

A discussion of the physical and chemical evidence on the crystal-structure of organic compounds of high molecular weight [M.A. 4-35, 98]. In particular it is shown that the polymerization products of formaldehyde, the polyoxymethylene derivatives, lead to the conception of a lattice built up from one-dimensional makromolecules, just as do the higher paraffin and fatty acid members. The makromolecules of the amorphous members are three-dimensional.

F. A. B.

HENGSTENBERG (J.) & MARK (H.). *Über die Gitterstruktur einiger einfacher Zucker*. Zeits. Krist., 1929, vol. 72, pp. 301-308, 3 figs.

Dextrose (*d*-glucose) has the space-group V^4 ; the unit cell contains four molecules of $C_6H_{12}O_6$ and has dimensions given by $a = 10.40$, $b = 14.89$, $c = 4.99$ Å. *d*-Cellobiose has the space-group C_2^2 ; the unit cell contains two molecules of $C_{12}H_{21}O_{11}$ and has dimensions given by $a = 5.00$, $b = 13.2$, $c = 11.1$ Å., $\beta = 90^\circ$. *d*-Fructose has the space-group V^4 ; the unit cell contains four molecules of $C_6H_{12}O_6$ and has dimensions given by $a = 8.06$, $b = 10.06$, $c = 9.12$ Å.

H. H.

Rock-forming Minerals and Petrology.

RIBA (Jaime Marcet). *Nuestros métodos estereográficos de determinación cristalográfica de los minerales de las rocas en preparación microscópica*. Mem. R. Soc. Española Hist. Nat., 1927, vol. 13, no. 4, pp. 249-368, 5 pls., 41 text-figs.

Describes and gives full lists of the literature on the methods which have been used for the crystallographic determination of the rock-forming minerals in thin sections. Various curves, whose properties have been studied, are first described. These include isogyres and isotaques, birefringence curves, and extinction curves. A second section describes methods based on the study of the optical ellipsoid, the determination of its orientation, optic sign, and 2V. Particular attention is given to methods based on measurement of birefringence, and in the concluding section the author has tabulated determinations of birefringence and 2V for the following: a series of albites ranging from 1 to 7.5% An.; labradorites and bytownites from camptonites at Bagur; orthoclase from teschenites at Ferragut (Mahón); uralite and various pyroxenes from the diabases at Camarena (Teruel); and zoned pyroxenes from the camptonites of Ibiza.

W. C. S.

RITTMANN (A.). *Die Zonenmethode. Ein Beitrag zur Methodik der Plagioklasbestimmung mit Hilfe des Theodolithischen*. Schweiz. Min. Petr. Mitt., 1929, vol. 9, pp. 1-46, 14 figs.

The determination of the approximate anorthite-content of plagioclase feldspars in thin sections can be rapidly made on the Fedorov universal stage by measuring extinction-angles in twin-lamellae in the zones perpendicular to (010) and to (001). Several definite crystallographic directions in these zones can often be identified in crystals in thin section, notably [100], [001], and [010]; also the

maximum extinction-angle can be measured by a short modification of Berek's method. The methods are based on a combination of the methods of Fouqué and Michel Lévy, combined with a correct determination of the twin-laws and the orientation of the section, made possible by the universal stage. Quicker than the Fedorov-Nikitin method, the zone-method gives results which compare tolerably well with those obtained by the complete solution: a further advantage is its applicability to small twin-lamellae and microliths.

W. C. S.

KOŁACZKOWSKA (Marja). *Badania mikroskopowe skaleni występujących w andezytach z Wzaru pod Czorsztynem, z uwzględnieniem nowych metod badania.*—*Études microscopiques des plagioclases provenant des andésites de Wzar tenant compte des nouvelles méthodes d'examen.* Arch. Min. Tow. Nauk. Warszaw. (Arch. Min. Soc. Sci. Varsovie), 1928, vol. 2 (for 1926), pp. 13-85 (Polish), pp. 86-90 (French résumé), p. 91 (table of contents), 7 pls., 127 text-figs.

KOŁACZKOWSKA (Marie). *Études microscopiques de plagioclases provenant des andésites de Wzar tenant compte de quelques nouvelles méthodes d'examen.* Zeits. Krist., 1929, vol. 72, pp. 58-106, 7 pls., 115 text-figs.

An outline of the general principles of the Fedorov method of determining the plagioclase feldspars introduces some theoretical considerations on complex twins and two new practical methods. The phenomenon of equal illumination of two halves of a twin is applied to the determination of the position of the twin-plane with a distinct gain in accuracy. By a development of Berek's 'characteristic extinction position' method and the graphical construction of T. J. Woyno [M.A. 3-321], diagrams have been constructed to enable the angle between the optic axes to be determined graphically when the position of the Fresnel ellipsoid and the extinction directions in the section are known. The diagrams are reproduced on five plates printed on tracing paper, so that they can be used in conjunction with stereographic nets of 20 cm. diameter. The plagioclase crystals in the andesites of Wzar, near Szczawnica [M.A. 3-520], are found to vary in anorthite-content between 59 and 69%. They are made the basis for the study of the manner of association of twins of three or four individuals, and in particular of the order in which lamellae belonging to different individuals are arranged. The association

albite, Carlsbad-A, and the complex Roc Tourné \perp [001], \parallel (010) is the most common, and it is demonstrated that the 'complex' Roc Tourné twin has a real existence and does not merely occur as a resultant of combined albite and Carlsbad-A twins. W. C. S.

ERDMANNSDÖRFFER (O. H.). *Über Alkalihornblenden aus dem Radautal*. Sitzungsber. Heidelberg. Akad. Wiss. Math. naturw. Kl., 1929, Abh. 17, 6 pp.

The presence of alkali-hornblendes in syenitic rocks in the Harz Mts. is unexpected, and a study has been undertaken of their properties. The predominant amphibole is a deep brown to black hornblende with the following characters. Pleochroism α very pale yellow, β red-brown with a violet tinge, γ yellowish- or brownish-green; $c:\gamma = 11-13^\circ$; γ' variable 1.653 to 1.683, $\gamma - \alpha$ 0.026; optic axial plane (010), $2V$ $50^\circ 20'$ to $59^\circ 40'$, negative, dispersion strong $v > p$. Small borders or oriented prisms are riebeckite. The pleochroism of the brown hornblende resembles that of katophorite but the extinction-angle is much higher. A 95% pure sample of the brown hornblende, sp. gr. 3.105, gave SiO_2 54.82, TiO_2 1.52, Al_2O_3 2.27, Fe_2O_3 3.52, FeO 6.08, MgO 17.60, CaO 7.14, Na_2O 3.68, K_2O 1.75, H_2O 1.78. This, using the latest formulae of W. Kunitz [M.A. 4-200], represents actinolite 56.64, glaucophane 16.94, riebeckite 16.80, with $\text{R}'_2\text{SiO}_3$ 3.82 and $\text{R}''_2\text{SiO}_4$ 6.04 %. W. C. S.

RICHARZ (Stephen). *A peculiar blue-green amphibole from the metamorphic iron formation of the eastern Mesabi Range, Minnesota*. Amer. Min., 1930, vol. 15, pp. 65-68.

A blue-green amphibole, associated with grünerite and quartz, occurs close to the granite contact at Babbitt. It forms fibrous felted masses or distinct blades. Pleochroism strong, α light yellow, β pea-green, γ deep blue-green; extinction on (010) about 16° , $2V$ about 54° ; α 1.670, β 1.690, γ 1.696. Analysis gave SiO_2 48.76, Al_2O_3 11.15, Fe_2O_3 7.92, FeO 21.72, MnO trace, MgO 0.38, CaO 6.16, Na_2O 1.67, K_2O 0.58, H_2O (+ 110°) 1.89 = 100.23. L. J. S.

ANGEL (Franz). *Über chemische Beziehungen gesteinsbildender Pyroxene und Amphibole untereinander und zum Muttergestein, dargestellt mit Hilfe des Niggli-Standard*. Zeits. Krist., 1929, vol. 69, pp. 455-475.

The author applies Niggli's method of calculating the 'standard mineral' composition of rocks and minerals to the study of the relation in composition between pyroxenes and amphiboles and their

parent-rocks. The 'mineral-norm' calculated for pyroxenes and amphiboles includes some standard minerals which are pyroxene- or amphibole-silicates, but others which are not, such as the felspar-, olivine-, and feldspathoid-molecules. The author shows how these 'Begleitsilikate' contribute to pyroxene- or amphibole-molecules such as the jadeite- and 'syntagmatite'-molecules, and by redistributing them he calculates an 'abgeleitete Mineralnorm'. By various examples it is shown that studies of the rock- and mineral-norms may be used to clear up the chemical and genetic relations between rocks and their constituent pyroxenes and amphiboles. The 'mineral-norms' of the pyroxenes and amphiboles of eclogites and amphibolites have been calculated and are compared in two tables, the analyses used being taken from the 'Elemente der Gesteinslehre' of Rosenbusch.

W. C. S.

TCHIRVINSKY (G. [sic]), [= CHIRVINSKY (P. N.)]. *Sur la précision du calcul du poids spécifique des roches à partir de leur composition minéralogique quantitative.* Bull. Soc. Franç. Min., 1924, vol. 47, pp. 136-140.

The proportions of mineral components in various rocks have been determined by a microscopic study of three thin sections of each specimen. The calculated and observed values of the densities of 48 rock-specimens are tabulated together with localities.

F. A. B.

REINHARD (M.). *Über die Dicke der Gesteinsdünnschliffe und der darin vorkommenden Mineralkomponenten.* Schweiz. Min. Petr. Mitt., 1927, vol. 7, pp. 40-44, 1 pl.

By cutting a transverse section across a pile of ten rock-slices of different rocks prepared by several makers and measuring their thickness with a micrometer the author has investigated the extent to which thin sections vary in thickness. In one and the same slice the variations are such that the assumption that thickness calculated from the birefringence of an orientated section of a mineral whose refractive indices are known (such as quartz) can only give very rough and unreliable results. For accurate optical determinations the thin sections of the rocks ought to be specially prepared.

W. C. S.

PRESTON (F. W.). *Ball-and-socket jointing in basalt prisms.* Proc. Roy. Soc. London, Ser. B, 1930, vol. 106, pp. 87-93, 1 pl., 8 text-figs.

Columnar structure in basalt sills is caused by lateral contraction accompanied by vertical compression. A cooling medium circulating

along the prismatic cracks will cause the isothermals in the columns to be curved, and the cross-fractures will take a curved course at right angles to the maximum tension. The fissure enters perpendicularly, giving a square lip to the basin, while the exit edge is inclined. A small spot in the centre remains unfractured. Whether the curved surfaces are directed upwards or downwards will depend on whether the cooling is proceeding from below or above. L. J. S.

BARTH (Tom. F. W.). *Über die Sagvandite und ihre Entstehung durch Syntexen von Dolomitgesteinen*. Min. Petr. Mitt. (Tschermak), 1930, vol. 40, pp. 221-234, 6 figs.

Additional remarks to a previous paper [M.A. 3-291]. The form of the rock mass in Norway is now stated to be a pipe. Similar rocks are mentioned from Finland and New Zealand. Sagvandites are associated with basic intrusive rocks and dolomitic sediments, and it is suggested that they have originated by the assimilation (syntexis) of dolomite by the basic magma. L. J. S.

ULRICH (František). *Problém karbonátosilikátových vyvěřelin a jejich geneze*. [The problem of the carbonate-silicate eruptive rocks and their genesis.] Sborník Přírodovědecký, České Akad., Praha, 1928, vol. 5, pp. 3-22, 1 pl.

A critical review of the discussions on the carbonate-silicate rocks of Alnö (Sweden), the Fen district (Norway), and other localities [M.A. 3-193]. N. L. Bowen's metasomatic interpretation is supported and illustrated by photomicrographs showing the replacement of silicates by calcite. For the teschenites of Moravia the same view is accepted, as opposed to R. A. Daly's syntectic theory recently supported by O. Pacák. A bibliography of 164 items is appended.

F. S.

KÔZU (Shukusuké). *Thermal studies of obsidian, pitchstone and perlite from Japan*. Sci. Rep. Tôhoku Univ. Sendai Japan, Ser. 3, 1929, vol. 3, pp. 225-238, 6 figs.

Cylinders were cut from various specimens of obsidian, perlite, and pitchstone from known localities, and the volume thermal expansions measured by a differential dilatometer method up to 1000° C. at atmospheric pressure. Obsidian expands gradually up to 600° C., then expands rapidly between 600° and 700° C., and

finally at about 900° C. it expands with explosive force. Volcanic slags of a basic character also exhibit the same phenomena, and the two temperatures of rapid expansion do not appear to vary much with the composition of the volcanic glass. Pitchstone and perlite, however, having expanded slightly up to 200 C., contract sometimes by as much as 10% by volume, and then expand explosively at temperatures variable for specimens from different localities. The change in refractive index of obsidian and pitchstone was measured after heating in nitrogen at various temperatures. No noticeable change occurs with obsidian up to 600° C. The thermal properties of obsidian as distinct from those of the other two volcanic rocks would seem to be characteristic, no matter what the pressure. F. A. B.

KÔZU (Shukusuké) & YOSHIKI (Bumpei). *Thermo-optic studies of anomite-basaltic hornblende-quartz-andesite in association with biotite-common hornblende-quartz-andesite, which together form the volcano Sambé in Japan.* Sci. Rep. Tôhoku Univ. Sendai, Japan, Ser. 3, 1929, vol. 3, pp. 177-193, 2 pls., 6 text-figs.

Bread-crust bombs ejected from the volcano Sambé, Daisen, north-west coast of southern Japan, are shown to have approximately the same composition and petrographic characters as the two different varieties of quartz-andesite forming the volcanic cone. The hornblende and biotite, however, have different optical characters in all three rocks. The reddish andesite from the outer portion of the lava-flow contains basaltic hornblende and anomite whose refractive indices remain unchanged on heating to 1000° C. The grey andesite from the inner mass of the lava-flow contains common hornblende of lower refractive index than the basaltic hornblende and meroxene of lower refractive index and optic axial angle than the anomite. The bread-crust bombs contain hornblende and meroxene of still lower refractive indices. When heated to above 400° C. the meroxene of both rocks changes to anomite with the same optical characters as that in the reddish andesite, and when heated to about 750° C. the common hornblendes are converted to basaltic hornblende [M.A. 3-494-5]. It is suggested that the differences in optical characters of the minerals in the three andesites are due to different contents of volatile components and FeO. The bombs containing hornblende and biotite of lowest refractive indices are supposed to be formed at a higher pressure and in a less oxidizing medium than the lava.

F. A. B.

MÜLLER (Wilhelm). *Untersuchungen über das "Grundgebirge" der Insel La Gomera (Canaren)*. Chem. der Erde, 1930, vol. 4, pp. 369-394; reprints as Inaug. Diss. Giessen, 1930.

The Tertiary or post-Tertiary volcanic rocks of the island of Gomera, Canary Islands, are underlain by a series of extensively weathered rocks which were believed by C. Gagel (1925) to represent a much older 'Grundgebirge'. A detailed examination, with several chemical analyses, of these rocks shows that they are only the weathered equivalents of the ordinary types of volcanic rocks, which include basalts, trachytes, and trachytic phonolites. Analyses are also given of the portions of the weathered rocks soluble in hydrochloric acid.

L. J. S.

EYLES (V. A.), SIMPSON (J. B.), & MACGREGOR (A. G.). *The igneous geology of central Ayrshire*. Trans. Geol. Soc. Glasgow, 1929, vol. 18, pp. 361-387, 3 figs.

A review of igneous activity in central Ayrshire from Lower Old Red Sandstone to Tertiary times. Particular attention has been paid to the petrology of the 'Permian' sills. The authors are not in agreement with G. W. Tyrrell [M.A. 2-349] in placing kyllite and teschenite in separate differentiation series. They regard the 'kyllite suite' and 'teschenite suite' as being intimately connected genetically. Sills of one sub-group are dolerites of sub-alkaline character with 'juvenile' quartz introduced often in the form of micropegmatite, and therefore bearing some resemblance to the quartz-dolerite of the Whin Sill. A tabular classification shows its relation to the types and rock series of Tyrrell.

W. C. S.

DENAEYER (M. E.). *Les roches alcalines du Sahara central*. Compt. Rend. Congrès Soc. Sav. Sci. Paris, 1924, for 1923, pp. 219-229.

R. Chudeau regarded Ahaggar as the western limit of the alkaline province of Lake Chad. The author claims that the rhyolite of In Zize in common with the rhyolite of Ahnet are devoid of magnesium-bearing minerals and may be placed in the group of alkaline rhyolites which contain no soda-amphiboles or pyroxenes. In addition, he draws attention to a microgranite from In Zize containing a soda-amphibole (laneite). Alkaline-granites with soda-amphiboles (hudsonite) also occur in Adrar des Iforass.

W. C. S.